NOTES ON SOME AUSTRALIAN GENERA AND SPECIES OF THE FAMILY MURICIDAE (NEOGASTROPODA)

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Plates 20 - 23.

ABSTRACT

Various genera and Australian species of the Muricidae are discussed and their taxonomic status reviewed, particularly in relation to the structure of their radulae and opercula.

The genus *Pterynotus* and its subgenera are discussed and the Australian occurrences of some species are noted. *Nothotyphis* Fleming is reduced to a synonym of *Tripterotyphis* Pilsbry and Lowe, a subgenus of *Pterotyphis* Jousseaume, and a new subspecies of this group is described. *Galfridus* Iredale is found to be only subgenerically distinct from *Phyllocoma* Tapparone-Canefri and the southern Australian *eburneus* (Petterd) is shown to be a subspecies of the East Coast *P. (G.) speciosa* (Angas). *Tritonidea petterdi* Brazier is a synonym of *Maculotriton bracteatus* (Hinds). Two species of *Aspella; anceps* (Lamarck) and *producta* (Pease), are recognised from Australia. The relationships of *Favartia* are discussed and *Murex confusus* Brazier is placed in this genus. *Murexiella* Clench and Fartante is reduced to a subgenus of *Favartia* and 5 Australian species are included, three of these being new. *Murexsul* Iredale is shown to be a synonym of *Muricopsis* Bucquoy et al and four Australian species are discussed, one being described as new. *Spinidrupa* Habe & Kosuge is probably a subgenus of *Muricopsis*. Several species are recorded from Australia for the first time.

INTRODUCTION

The Muricidae contains some of the more attractive and popular species of neogastropods yet very little is known of their habits, reproductive biology or anatomy. Their classification is based on shell, radular and opercular features but only the shell is known for the vast majority of species. The systematics of this family have suffered, in many instances, from over enthusiastic " splitters " basing taxa on minor shell features. Many species and genera in this family appear to exhibit considerable variation in shell features so that " lumping " will often prove to be a necessity. Before some of the more complex genera can be effectively worked out the examination of large series of specimens will be required. A number of genera containing fewer, sometimes rather inconspicuous (and hence often overlooked) species, are particularly in need of revision and it is to attempt to clarify the status of a few of these genera that is the primary purpose of this paper.

During the course of this work a few new species were encountered and these have been described. In addition, because the Australian occurrences of some of the less common Indo-Pacific species have never been well tabulated, the localities of specimens in the Australian Museum are listed and their registered numbers given so that these species can be recognized as definite members of the Australian fauna.

TAXONOMY

Genus *Pterynotus* Swainson, 1833

Type species: (s.d. Swainson, 1833) *Murex pinnatus* Swainson, 1822 = *alatus* Röding, 1798.

Vokes (1964) described and figured a radula said to be that of *P. pinnatus* (=*alatus*) the central tooth of which had three long cusps on a simple short basal plate. A small specimen from Warrior Reef, north Queensland, in the Australian Museum (Plate 20, fig. 1) contained a dried animal from which a radula was extracted. This proved to be different from Vokes' radula in having a long basal plate and 3 short cusps with small intermediate denticles between them (Text fig. 1:1). The operculum is elongate, with a terminal nucleus.

The radula of *Pterynotus (Pterochelus) acanthopterus* (Lamarck, 1816), (Text fig. 1: 2a, b), the type species of the subgenus *Pterochelus* Jousseaume, 1880, is like that of the Warrior Reef *P. alatus* but the shell differs in having a long spine at the posterior corner of the aperture. The operculae of species of this group (Text fig. 4: 32, 33) are also similar to those of typical *Pterynotus* species.

The recent species of the *acanthopterus* group in Australia *(triformis* Reeve, 1845 and *duffusi* Iredale, 1936) appear to grade into one another and may possibly prove to be all one species. Any attempt at a revision of this group should await the accumulation of much more material than is available at present.

P. (P.) triformis often has a very short posterior spine so that the commonly cited differences between *Pterynotus* and *Pterochelus* are not particularly clear-cut. Examination of the protoconchs, however, shows that the type species of *Pterynotus* has a conical multispiral protoconch, whereas that of *P. (P.) acanthopterus* and its associated "species" is paucispiral with a strongly tilted nucleus. The only other species attributable to typical *Pterynotus* available to the writer that had a partially intact protoconch was *P. patagiatus* (Hedley, 1912). This species agrees with *alatus* in its solid white shell, crisp scabrose sculpture, multispiral protoconch, single inter-variceal nodule, rather long anterior canal and lack of a posterior canal.

Pterynotus tripterus (Born, 1778), a species placed in *Naquetia* by Cernohorsky (1967), also agrees in teleoconch features with *P. alatus*. Cernohorsky describes the protoconch of this species as having "2 calcified (nuclear) whorls" which suggests that the protoconch was probably eroded. Placement in *Pterynotus* (s.s) seems a much better location for this species, particularly as the type species of *Naquetia* Jousseaume, 1880, *Murex triqueter* Born, 1778, has very different sculpture. Cernohorsky (1967) figured the radula of *triqueter* which appears to be basically like those of *Pterynotus* and *Pterochelus* but differs in the middle cusp of the central tooth being relatively longer, the intermediate cusps vestigial and the outer cusps very short.

Vokes (1964) includes *Rhizophorimurex* Oyama, 1950 (type species *Murex capucinus* Lamarck, 1822) in the synonymy of *Naquetia* but Cernohorsky (1967) correctly includes the species usually interpreted as *capucinus* Röding, 1798 (=*capucinus* Lamarck, = *permaestus* Hedley, 1914) in *Chicoreus* Montfort, 1810 (type species *Murex ramosus* Linnaeus, 1758). Vokes (1970b) has discussed the nomenclature of this species in detail.

Vokes (1964) reduced *Marchia* Jousseaume, 1880 (type species (o.d.) *Murex clavus* Kiener, 1843 = *M. elongatus* Lightfoot, 1786) to a synonym of *Pterynotus* and on teleoconch characters this seems to be a reasonable judgement.

Beu (1970) transferred *Murex bednalli* Brazier, 1877 from *Pterynotus* to *Pteropurpura* Jousseaume, 1880. The operculum (Text fig. 4: 30) and radula (Text fig. 1: 3) of *M. bednalli* were examined and found to be similar to those of *alatus* and *acanthopterus*. The protoconch of this northern Australian species resembles that of *acanthopterus* but there is only a vestige of a posterior canal present. The shell sculpture, light build, and sometimes dark coloured shell all suggest placement in *Pterochelus*.

The radulae of two species attributed to *Pteropurpura* are illustrated (Text figs. 2: 14, 15) for comparison with those of *Pterynotus*. Vokes (1964) has figured the operculum of the West American *P. carpenteri* Dall, 1899 (=*macropterus* Deshayes, 1839, as shown by Emerson, 1964) the type species of the genus. The operculae of the two species from which the radula is figured, is similar in having a latero-terminal nucleus, one being figured here (Text fig. 4: 34). In shell features *Pteropurpura* and *Pterochelus* are almost indistinguishable, species in the two groups even having similar protoconchs. The relationship of *Pteropurpura* to its subgenus *Ocinebrellus* Jousseaume, 1880 is obviously very close and their radulae are also similar (c.f. Text figs. 2: 14, 15) and that of *O. aduncus* (Sowerby, 1834) figured by Vokes (1964). The radulae and operculae of two Californian species, *Jaton decussatus* (Gmelin) and *Shaskyus festivus* (Hinds), have recently been figured (Burch and Campbell, 1963), these species being the types of their respective genera. Both are closely related to *Pteropurpura* and may be only subgenerically distinct.

The Australian occurrences of *Pterynotus* (s.s.) species have been poorly documented. An attempt to list the known records is made below. This is based on material in the Australian Museum and on published information. McMichael (1961) has recently discussed the records of *P. patagiatus* (Hedley).

Pterynotus (Pterynotus) alatus (Röding)

Plate 20, fig. 1; Text fig. 1: 1

1798 *Purpura alata* Röding, *Mus. Bolten.*: 144 (no. 1085) (ref. Martini, 1777, 3, t. 111, figs. 1036, 1037).

1822 *Murex pinnatus* Swainson, *Cat. Coll. Bligh*, App.: 17.

1845 *Murex pellucidus* Reeve, *Conch. Icon. Murex.* pl. 14, sp. 54.

Vokes (1970b) has suggested that an appeal be made to the International Commission for Zoological Nomenclature to " conserve the well-known *pinnatus* ". In a clear cut case of unconfused priority such as this, an application probably should not be made, particularly as the name *alatus* is now gaining general usage.

Reeve's illustration of *Murex pellucidus* has a wider variceal flange than most specimens of *alatus* encountered. Dredged specimens usually have this delicate flange developed whereas specimens obtained from shallow water have the solid varices normally associated with *alatus*. The two forms intergrade and are clearly the same species.

Although previously recorded from 30 fathoms, Darnley Island, Torres Strait by Brazier (1877), the specimen cannot now be located in the Macleay Museum. There are specimens in the Australian Museum from the following Australian localities: Warrior Reef, North Queensland (C. 76626); Port Darwin, Northern Territory (C. 55056); vicinity of Cape Moreton, Queensland, trawled (C. 74904).

Pterynotus (Pterynotus) tripterus (Born, 1778)

1778 *Murex tripterus* Born; *Ind. Rer. Nat. Mus. Caes. Vindob.*: 287.

1780 *Murex tripterus* Born; *Test. Mus. Caes. Vindob.*: 291, t. 10, figs. 18, 19.

1967 *Pterynotus (Naquetia) tripterus*. Cernohorsky, *Veliger*, 10 (2): 124, pl. 15, fig. 14.

This species is not uncommon on the Great Barrier Reef, Queensland but was not recorded from Australia by Hedley (1910). Cotton (1956) records the species from Queensland and Northern Australia. There are specimens in the Australian Museum from the following localities in Queensland: Fairfax Island, Bunker Group (C. 69053, C. 77016); Tryon Island, Capricorn Group (C. 76868) (specimen recorded by Kerslake, 1957); Lady Elliot Island, Bunker Group (C. 69173); Mackerel Bay, Hook Island, Whitsunday Group (C. 68998).

Pterynotus (Pterynotus) elongatus (Lightfoot, 1786)

1786 *Murex elongatus* Lightfoot, *Cat. Port. Mus.*: 65 (no. 1479) (ref. Favanne, 1780, pl. 79, fig. H).

1842 *Murex clavus* Kiener, *Spéc. Gen. Icon. Coq. Viv., Murex*: 111 - 112, pl. 37, figs. 2, 2 (non Michelotti, 1841).

1967 *Pterynotus elongatus*. Cernohorsky, *Veliger*, 10 (2): 123, pl. 15, fig. 13.

This very characteristic, elongate species has been reported from Queensland by Cotton (1956) and Kerslake (1957) reported it from Tryon Island. Her specimen is now in the Australian Museum (C. 75770) along with a specimen from Fairfax Island in the Bunker Group (C. 68519).

Pterynotus (Naquetia) triqueter (Born, 1778)

1778 *Murex triqueter* Born, *Ind. Rer. Nat. Mus. Caes. Vindob.*: 288.

1780 *Murex triqueter* Born, *Test. Mus. Caes. Vindob.*: 291, t. 11, figs. 1 - 2.

1967 *Pterynotus (Naquetia) triqueter*. Cernohorsky, *Veliger*, 10 (2): 124, pl. 15, fig. 15; text fig. 6.

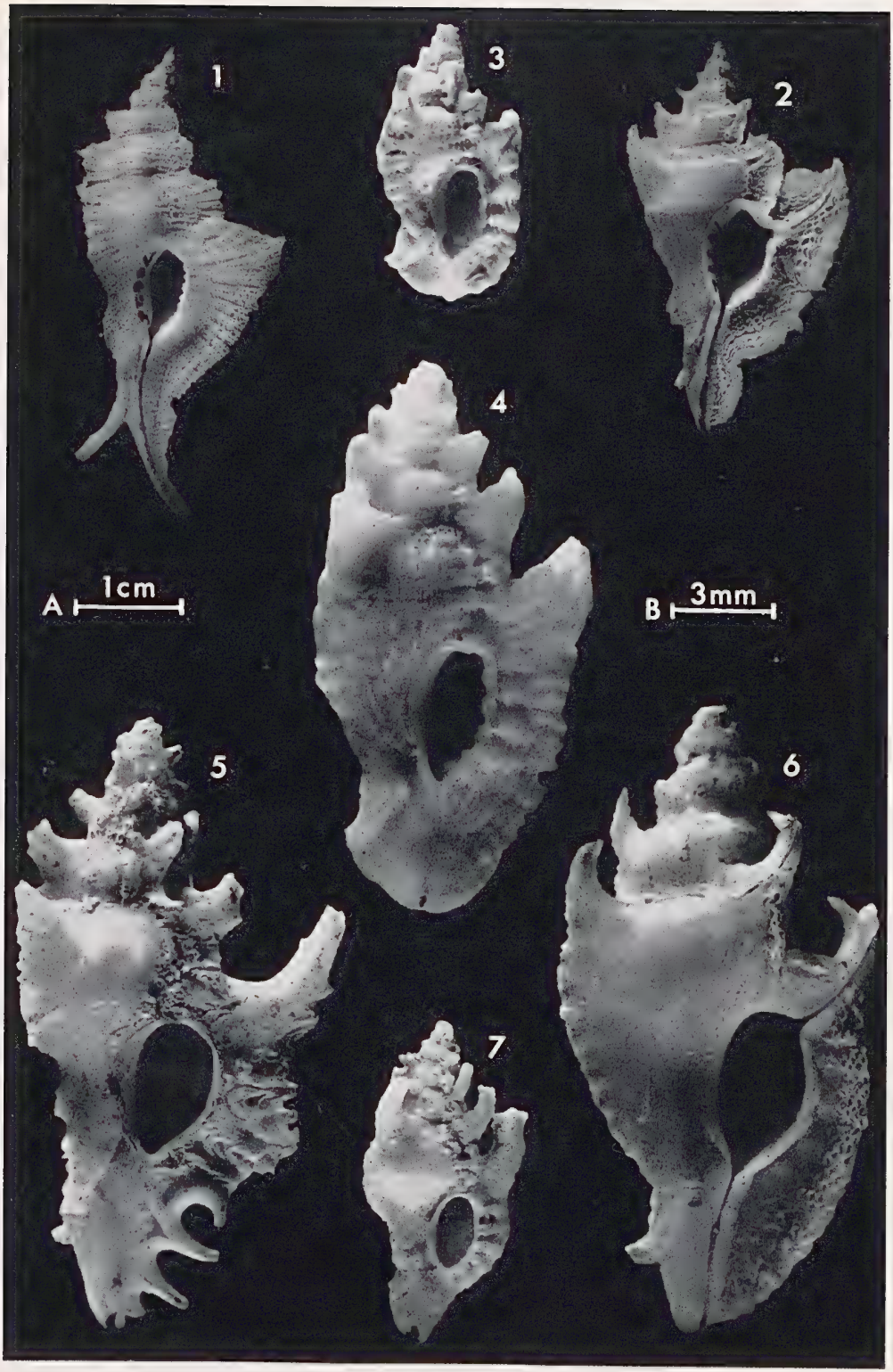
Neither Hedley (1910) nor Cotton (1956) recorded this species from Queensland but Kerslake (1957) reports it from Tryon Island, Queensland, this specimen now being held in the Australian Museum (C. 77007). Other specimens in the Australian Museum are from the following Queensland localities: Fairfax Island, Bunker Group (C. 69053); Brampton Island (C. 77005); West Cay, Diamond Islets, Coral Sea (C. 69165); Herald Cays, Coral Sea (C. 69064; C. 77011).

PLATE 20.

1. *Pterynotus (Pterynotus) alatus* (Röding). Warrior Reef, North Queensland (C. 76626). *
2. *Pterynotus (Pterochelus) acanthopterus* (Lamarck). Broome, North West Australia (C. 76582). *
3. *Pterynotus (Tripterotyphis) lowei norfolkensis* (Fleming). Norfolk Island (C. 59390). *
4. *Pterotyphis (Tripterotyphis) lowei colemani* subsp. nov. Tryon Island, Queensland, holotype, (C. 77189).
5. *Pterotyphis (Prototyphis) zelandicus iredalei* (Fleming). Norfolk Island (C. 59391). *
6. *Pterotyphis (Prototyphis) angasi angasi* (Crosse). Camp Cove, Sydney Harbour, N.S.W. (C. 77139). *
7. *Pterotyphis (Tripterotyphis) robustus* (Verco). Backstairs Passage, South Australia, paratype. (C. 41864).

Scale A: fig. 1 - 2; Scale B: fig. 3 - 7.

* Specimens from which figured radulae obtained.


1
3
2
4
A 1cm
B 3mm
5
6
7

Genus *Pterotyphis* Jousseaume, 1880

Type species: (o.d.) *Typhis pinnatus* Broderip, 1833.

Two subgenera, *Tripterotyphis*, Pilsbry and Lowe and *Prototyphis* subgen. nov. are recognised in the Australian fauna.

Subgenus *Tripterotyphis* Pilsbry and Lowe, 1932

Type species: (o.d.) *Typhis lowei* Pilsbry, 1931.

Synonym: *Nothotyphis* Fleming, 1962 (type species: (o.d.) *Pterynotus (Nothotyphis) norfolkensis* Fleming, 1962).

Keen (1944) and Vella (1961) allow *Pterotyphis* full generic rank and make *Tripterotyphis* a subgenus. The only apparent difference between the two type species is the position of the posterior siphonal tubes. In *Tripterotyphis* they are " wholly concrescent " with the varices, whereas in *Pterotyphis* they lie slightly behind the varices.

Fleming (1962) distinguished a new subgenus (of *Pterynotus*), *Nothotyphis*, from the otherwise almost identical West American species, *Pterotyphis (Tripterotyphis) lowei*, by the " variceal origin " of the siphonal tube. The variceal origin of this tube is shown by the " closure of opposing shell lips over a canal on the front of the varix, leaving a suture to mark the line of closure ". Keen and Campbell (1964) have described the mode of formation of the tube in another West American species, *Pterotyphis (Tripterotyphis) fayae* Keen and Campbell. This description clearly shows a similar formation of the tube to that seen in *Typhis angasi* Crosse, 1863 (see below) and in *norfolkensis*. I would agree with Gertman (1969) that *Tripterotyphis* and *Nothotyphis* should not be retained as separate groups, let alone placed in different " subfamilies ". *P. (T.) lowei* hardly differs at all from *norfolkensis* in shell features and is even closer to the new subspecies described below. These three forms are here regarded as conspecific.

The radula of *Pterotyphis (Tripterotyphis) lowei norfolkensis* (Text fig. 2: 18) is similar to that of " *Typhis* " *angasi* Crosse (Text fig. 2: 16), but the central tooth has a stouter, relatively shorter median cusp and larger lateral denticles.

Pterotyphis (Tripterotyphis) lowei colemani subsp nov.

Plate 20, fig. 4

Shell: Small, yellowish-white, solid, spire about 5/12 height of body whorl and canal. Protoconch of $1\frac{3}{4}$ rounded whorls, the first whorl slightly tilted (from Murray Island specimen). Teleoconch with about 6 very lightly convex whorls, 3 rather thin varices per whorl, each slightly behind that of the previous whorl giving each line of varices a slight twist. Posterior canal enclosed in a tube-like extension of the aperture which protrudes from the upper part of the terminal varix. This siphonal tube is twisted dorsally and orientated posteriorly. It has a line of closure on its ventral (apertural) face, a circular opening and is continued into a buttress-like basal portion behind the varix. Sculpture of low, rather flat, spiral cords, 4 on body whorl and 1 on base, with traces of 4 additional semiobsolete cords on base. The spirals become prominent only where they pass over the varices where they form thick ridges which have deep pits between them on the apertural face of each varix. The

cords correspond to the pits between the labial denticles. The whole surface is crossed by irregular axial growth lines and weak, often indistinct, spiral threads. The growth lines become scaly in the pits on the varices. Aperture with raised peristome, anterior siphonal canal closed, straight except for the terminal portion which opens as a narrow tube dorsally. Posterior siphonal canal communicating with aperture by a small hole lying just behind peristome. Inner lip smooth, outer lip with 5 denticles, the 2nd and 3rd being bifid in the holotype.

Dimensions: Height: 16.86 mm. Diameter: 8.62 mm. (holotype)
15.80 mm. 8.00 mm. (paratype)

Locality: Tryon Island, Capricorn Group, Southern Queensland, subtidal on reef, collected by N. Coleman, July, 1969 (holotype C. 77189). Paratype in N. Coleman collection.

Additional material examined: Under stone, low tide on reef, Murray Island, Torres Strait, C. Hedley (one juvenile) (C. 29504); on beach, Murray Island, Torres Strait, C. Hedley (one juvenile) (C. 29390); 9-15 metres Murray Island, Torres Strait, C. Hedley (5 juveniles and one subadult) (C. 77278).

Remarks: The holotype of *lowei colemani* differs from *lowei norfolkensis* (Plate 20, fig. 3) in its much larger size (the holotype of *norfolkensis* is 9.5 x 5 mm) and weaker spiral cords. The whorls of the Norfolk Island subspecies are more convex and more impressed at the sutures compared with *colemani*. The varices in *norfolkensis* are thicker, with prominent swellings where the spiral cords cross. In *colemani* they are thin-edged and only slightly crenulated by the cords. There are 4 specimens of *P. (T.) lowei norfolkensis* from Lord Howe Island (collected R. Bell) in the Australian Museum (C. 59576, C. 59577) and these agree very well with Norfolk Island specimens except that they are larger in size, one adult measuring 12.2 x 6.5 mm. *P. (T.) lowei norfolkensis* appears to be restricted to Norfolk and Lord Howe Islands.

Pterotyphis (Tripterotyphis) lowei lowei is similar in size, colour and shape and in most details of sculpture to *colemani*. The siphonal tubes are bent more acutely dorsally in *lowei colemani*. If it were not for the fact that *lowei* is a Central west American species, the Queensland form would hardly be worthy of separation.

Pterotyphis (Tripterotyphis) robustus (Verco, 1895) (Plate 20, fig. 7) which was included in *Nothotyphis* by Fleming (1962), has the spiral cords visible only at the varices where they form strong pillars. The aperture has no prominent denticles and the variceal tubes are much longer, twisted posteriorly and only slightly dorsally.

Subgenus *Prototyphis* subgen. nov.

Type species: *Typhis angasi* Crosse, 1863.

Subgeneric diagnosis: SHELL: small, with medium to long posterior siphonal spines which are wholely or partly closed. Anterior canal rather long, tilted dorsally, almost closed but not completely fused. Varices 3 per whorl, with weak scaly sculpture, bearing the siphonal spines and few, if any, accessory spines. Aperture with smooth margins, peristome extended beyond varix and parietal wall. Protoconch flat-topped with strongly angled periphery; paucispiral. OPERCULUM: simple, with terminal

nucleus. RADULA: with short cental teeth, the cusps bent over the basal plate. 3 cusps on central tooth, with small intermediate cusps between them and strong lateral denticles (Text fig. 2: 16, 17).

Remarks: This subgenus is provided for *Typhis angasi,* a species usually included in *Pterynotus* or *Poropteron* by recent writers. Apart from *angasi* (Plate 20, fig. 6), this subgenus also contains the New Zealand species *Typhis zelandicus* Hutton, 1873. A specimen of the Norfolk Island subspecies of *zelandicus, iredalei* Fleming, 1962,* is illustrated (Plate 20, fig. 5). *P. (P.) angasi* has been shown (Fleming, 1962) to have two New Zealand subspecies, the Recent *eos* Hutton, 1873 and the Pleistocene *powelli* Fleming, 1962.

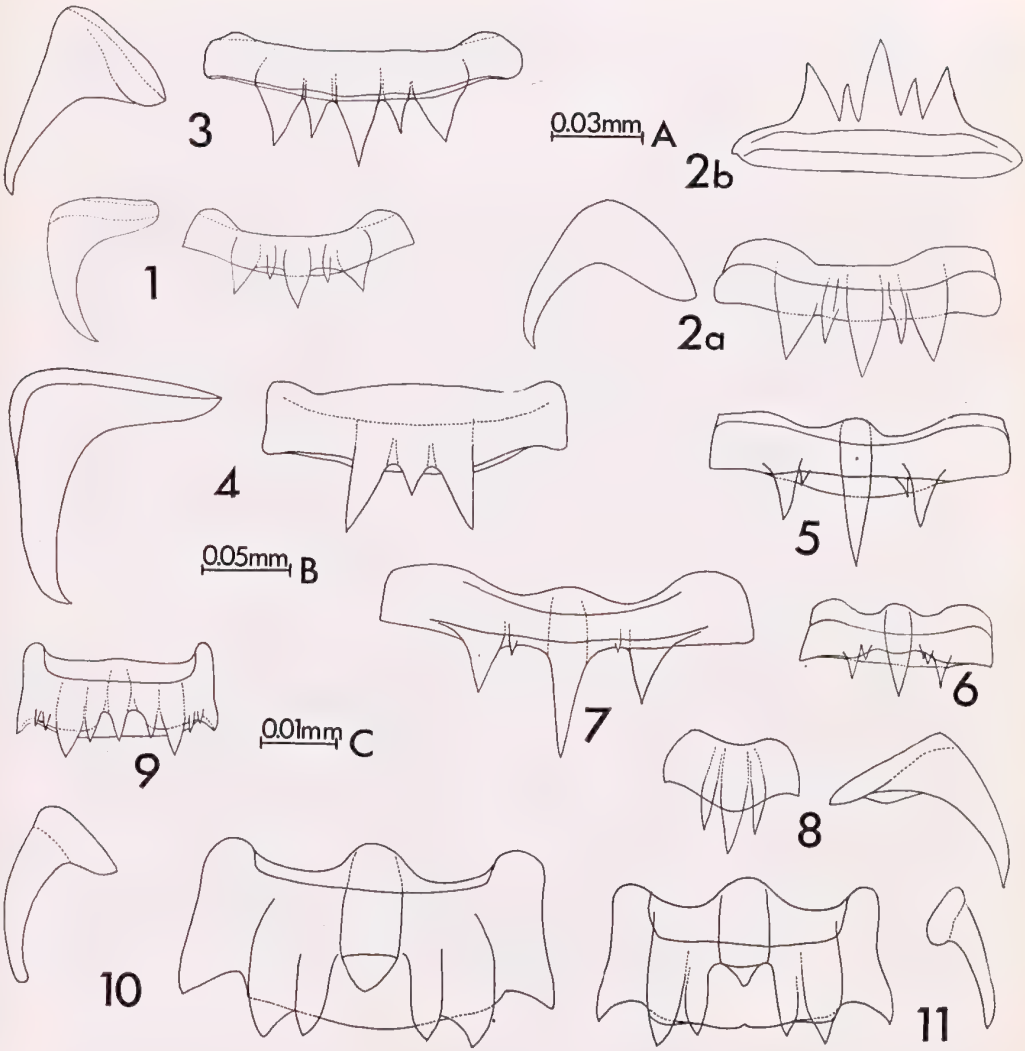
This subgenus is similar to *Pterotyphis (Tripterotyphis)* but differs in the simple, thin, scaly varices, subobsolete spiral sculpture, keeled protoconch and smooth peristome. The exact limits of the genera and subgenera in these groups cannot be satisfactorily defined until, at least, more radulae have been examined. Neither of the West American species *(P. (T.) lowei* and *fayae)* have had their protoconchs described, but examination of a specimen of *lowei* shows that this species has a protoconch like that of *P. (T.) norfolkensis.*

* Gertman (1969) suggests that this subspecies may be *Murex canaliferus* Sowerby, 1841.

Although superficially similar to *Pterynotus (Pterochelus) triformis, Prototyphis* species differ in their smaller size, keeled protoconch and, particularly, in the formation of a posterior siphonal tube. In *P. (Pterochelus) acanthopterus* a long spine is usually developed which is superficially very similar to the siphonal tube of *Prototyphis.* This spine, however, does not seem to serve as a functioning posterior canal because, in mature individuals it is closed off at its base and outer end and bypassed over its base by a short groove. It is thus quite different from the analogous structure in *angasi* and *zelandicus.* In these two species the spine is always open at its proximal and distal ends and obviously functions as a siphonal canal. It is never quite fused in *angasi* but is fused in *zelandicus.* Fleming (1962) and Vokes (1970c) have both argued that the *Typhis* — like tube of *Prototyphis* species was produced by the closure of the *Pterochelus* spine. The radular evidence does not seem to support this view.

The South African genus *Poropteron* Jousseaume, 1880 (type species: (o.d.) *Murex uncinarius* Lamarck, 1822) was thought (Finlay, 1927; Iredale and McMichael, 1962), apparently incorrectly, to have close affinity with the species here placed in *Prototyphis.* Vokes (1964) placed *Poropteron* in the " Tritonaliinae " on the basis of its resemblance to *Purpurellus* Jousseaume, 1880. Emerson and D'Attilio (1969) have discussed the relationships of *Purpurellus* which they show to be a subgenus of *Pterynotus.* It has a very similar radula to that of *Pterynotus alatus* but the operculum has an almost central nucleus.

Most of the shell features of *P. uncinarius* agree rather well with *angasi* and *zelandicus* except that the long, curved, hollow posterior spines that are characteristic of the genus are not open to the aperture and are thus not siphonal structures. Possibly this genus is related to *Pterynotus* but as yet the radula and operculum have not been described.



TEXT FIG. 1. Radular teeth.

1. *Pterynotus (Pterynotus) alatus* (Röding). Warrior Reef, North Queensland (C. 76626).
2a, b. *Pterynotus (Pterynotus) acanthopterus* (Lamarck). Broome, North West Australia (C. 76582).
3. *Pterynotus (Pterochelus) bednalli* (Brazier). Swires Bluff, Darwin Harbour, Northern Territory (C. 71742).
4. *Phyllocoma (Galfridus) speciosa speciosa* (Angas). Watson's Bay, Sydney, N.S.W. (C. 76669).
5, 6. *Maculotriton bracteatus* (Hinds). Lady Musgrave Island, Bunker Group, Queensland (C. 77187).
7. *Phrygiomurex sculptilis* (Reeve). Funafuti, Ellice Islands (C. 5996).
8. *Phyllocoma (Phyllocoma) convoluta* (Broderip). Suva Harbour, Fiji (C. 67022).
9. *Favartia (Murexiella) brazieri* (Angas). Vaucluse, Sydney, N.S.W. (C. 6379).
10. *Favartia (Murexiella) salmoneus* (Melvill and Standen). 9 - 15 metres, Murray Island, Torres Strait (C. 29961).
11. *Favartia (Murexiella) striasquamosa* sp. nov. Lindeman Island, Queensland, holotype (C. 76670).

Scale A: fig. 1 - 4; Scale B: fig. 5 - 8; Scale C: fig. 9 - 11.

Discussion on the Typhinae

The method of formation of the siphonal tube in the more typical members of the "Typhinae" is like that seen in *Pterotyphis (Tripterotyphis)* and *P. (Prototyphis)* but in the more modified genera the tubes lie between the varices. In *Pterotyphis* s.s. the tube has moved back a little behind the varix and in *Typhis* s.s. lies midway between the varices. In *T. (Typhisopsis)* Jousseaume, 1880 the tube has migrated back to lie in front of the preceding varix. It is thus formed just in advance of each varix. In all cases an indistinct line of fusion is seen running from the edge of the varix to the base of the tube and along its ventral face. Internally the opening of the last tube is seen as a small aperture (these apertures are sealed off behind). Intervariceal specimens of *Typhis* (s.l.) species are rarely seen and it would appear that the growth of the shell between the varices is rapid to avoid a prolonged period with the shell lacking any strengthening at the edge of the aperture. In addition, the relationship of the pallial structures to the narrow posterior siphonal aperture would be upset during growth.

The advantages of the posterior siphonal tube are analogous to the notch of the turrids and bursids which has been developed in the posterior corner of the aperture. Waste material can be disposed of well clear of the head foot and the anterior siphon. In addition the shell can remain partially buried in mud or sand and as long as the anterior siphon has contact with the surface respiration should proceed normally.

Some species of *Typhis* (s.l.) have variceal spines as well as the intervariceal siphonal tubes. These spines however, do not open in to the aperture and are only ornamental. The Typhinae are thus, at least on shell features, rather distinctive, but the radula of *Typhis (Haustellotyphis) cumingii* (Broderip) as figured by Thiele (1929) and described by Vokes (1964) as typical of the Typhinae, is by no means the only type encountered. An Australian species, *Typhis (Typhina) philippensis interpres* (Iredale, 1924) examined by the writer has a radula typical of the Muricinae (Text fig. 2: 19).

The "Typhinae" would appear to represent a specialized off-shoot from the "Muricinae". As with the other so-called subfamilies of the Muricidae the limits are difficult to define. *Prototyphis* for example is certainly on the borderline of the two subfamilies.

Genus *Phyllocoma* Tapparone-Canefri, 1881

Type species: (monotypy) *Triton convolutus* Broderip, 1833.
Synonym: *Craspedotriton* Dall, 1904 (type species: (o.d.) *Triton convolutus* Broderip).

Subgenus *Phyllocoma* ss.

1833 *Triton convolutus* Broderip, *Proc. Zool. Soc. Lond.*: 7.

Phyllocoma (Phyllocoma) convolutus (Broderip, 1833)

Plate 23, fig. 10; Text fig. 1: 8

Cotton (1956) records *P. (P.) convoluta* from Darwin, northern Australia and there is a juvenile specimen in the Australian Museum found in a fish stomach in the "Capricorn Group", Queensland (C. 76937). There are specimens in the Australian Museum collections from Mauritius

(C. 77286), Fiji (C. 67022, C. 67460), Lifu, Loyalty Islands (C. 28701) and Santa Cruz Islands, S. Pacific (C. 4210). A specimen from Fiji is figured (Plate 23, fig. 10) for comparison with *P. (Galfridus) speciosa* (Angas).

Subgenus *Galfridus* Iredale, 1924

Type species: (o.d.) *Triton speciosus* Angas, 1871.

Most Australian writers have given *Galfridus* full generic status (Cotton, 1956; Macpherson and Gabriel, 1962, etc.). Thiele (1929) regarded *Galfridus* as a subgenus of *Phyllocoma* and this was followed by Wenz (1941). The shells of the type species of both groups are similar (c.f. Plate 23, figs. 9, 10) being spirally sculptured with distinct, rounded varices, convex whorls, inflated body whorls, and simple apertures with a narrowly open canal of moderate length.* The protoconch of *P. convoluta* has not been described and the species is apparently normally decollate. *G. speciosa* often retains the protoconch, although decollate specimens are not uncommon. The protoconch of *speciosa* (figured by Kesteven, 1902) is of about $1\frac{3}{4}$ convex whorls with indistinct spiral scratches. Normal specimens of *convoluta* have only 2 varices per whorl, *speciosa* usually has between 2 and 7. Both species have axial striae but this is stronger in *speciosa*.

The operculum of *speciosa* (Text fig. 4: 36) has been previously figured by Kesteven (1902) although his drawing does not depict the position of the nucleus accurately. In both *speciosa* and *convoluta* the reddish operculum has the nucleus in a laterotermínal position and they are nearly identical in all other features.

Thiele's (1929) illustration of the radula of *speciosa*, which is copied from Kesteven (1902), shows the central tooth having 3 almost equal cusps, the middle one being very slightly longer. The radulae of 2 specimens from N.S.W. were examined and these were found to be nearly identical and differ considerably from Kesteven's illustration (Text fig. 1: 4). The central teeth are wide, with the 3 cusps close together, the central cusp being shorter than the lateral cusps — but varying a little in relative length between the two specimens examined. The basal plate bears lateral protruberances and the lateral teeth are large and simple.

The radula of a specimen of *Phyllocoma convoluta* from Fiji was examined (Text fig. 1: 8) and found to have similar central teeth to those of *speciosa* but they have a shorter, relatively deeper base, massive, curved central cusps and smaller lateral cusps. The lateral teeth are relatively very large and there is a peculiar, elongate bulge at the base of the single cusp on each tooth.

In view of the similarity in teleoconch and opercular features and the general similarity of the radula, *Phyllocoma* and *Galfridus* should be regarded as belonging to the one genus-group. The differences in the radula, however, appear to be sufficient to warrant subgeneric separation.

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* Iredale (1924) states that *Phyllocoma convoluta* has a closed canal, but this does not appear to be the case.

Phyllocoma (Galfridus) speciosa (Angas, 1871)

Plate 23, fig. 9; Text fig. 1:4, 4:36

1871 *Triton speciosus* Angas, *Proc. Zool. Soc. Lond.*: 13, pl. 1, fig. 7.

P. (G.) speciosa appears to exist as 3 subspecies. The southern Australian form *eburnea* Petterd, 1884, has been given full specific status but agrees with *speciosa speciosa* from south eastern Australia (N.S.W.) in nearly every way except that it usually has 2-3 varices per whorl, compared with 5-7 in the N.S.W. form. This form extends at least as far north as the Richmond River area (C. 76905, C. 76906) in N.S.W. and there is one broken specimen from 115-124 metres off Cape Moreton, Queensland, in the Australian Museum (C. 73518). 4 specimens from Lindeman Island, Whitsunday Passage, Queensland (C. 77282) are very similar to N.S.W. shells. A specimen from Malacoota, eastern Victoria, is intermediate between *speciosa* and *eburnea* (C. 50552).The similarity between these forms was recognized by Hedley (1913) who discussed the synonyms of this species. *Trophon virginalis* Suter, 1913 from northern New Zealand is probably a third geographic subspecies of *speciosa*.

Genus *Maculotriton* Dall, 1904

Type species: (o.d.) *Triton bracteatus* Hinds, 1844.

Maculotriton is distinguished from other muricoid genera by its small size, tall spire, axial ribs crossed by fine spiral cords that do not form spines or knobs. Usually no additional varices are formed except perhaps for a few on the body whorl. The protoconch is conical and consists of about 4 whorls. In many ways the shell has more the appearance of a small cymatiid or 'triton' than a muricid.

The radula of *M. bracteatus* (Text figs. 1: 5, 6), previously figured by Pilsbry & Vanatta (1904) shows a strong resemblance to that of *Phrygiomurex sculptilis* (Reeve, 1844) which has been described and figured by Arakawa (1965). The operculum is simple, yellow, with a terminal nucleus.

This genus was considered to be a subgenus of *Drupa* Röding, 1798 by Thiele (1929) and Wenz (1941). The shell, opercular and radular features (see Cernohorsky, 1969) of the type species of *Drupa, D. morum* Röding, 1798, are very different from those of *Maculotriton*.

Cernohorsky (1969) records *M. egregius* (Reeve, 1844) from Fiji. This figure and description do not agree at all with Reeve's shell and it is doubtful if the species figured by Cernohorsky is a *Maculotriton*.

Maculotriton bracteatus (Hinds, 1844).

Plate 23, figs. 1-5; Text fig. 1: 5, 6.

1844 *Triton bracteatus* Hinds, *Proc. Zool. Soc.*: 21.
1848 *Columbella epidelia* Duclos (in Chenu), *Illust. Conch., Columbella* (1846 - 1858) : pl. 25, figs 17-18.
1872 *Tritonidea petterdi* Brazier, *Proc. Zool. Soc.*: 22.
1896 *Clathurella* (?) *waterhouseae* Brazier, *Proc. Linn. Soc. N.S.W.*, 21: 345.
1904 *Maculotriton bracteatus longus* Pilsbry and Vanatta, *Proc. Acad. Natr. Sci. Phil.*: 595.

Hedley (1906) showed that *Cantharus waterhouseae* and *Columbella epidelia* were synonyms of *M. bracteatus*. The specimen figured by Hedley (1906) as the type of *waterhouseae* is actually the specimen mentioned

by Brazier in the footnote to his description. The holotype is here figured for the first time (pl. 23, fig. 5).

The holotype of *Tritonidea petterdi* Brazier (Plate 23, fig. 1) has never previously been figured. Tate & May (1901) showed that the type locality given by Brazier as "N.E. Coast of Tasmania" was incorrect and that the holotype was actually found on "Bird Island, N.E. Australia". This species has been known only from the holotype which proves to be a worn and faded specimen of *M. bracteatus*.

The shell of *M. bracteatus* is rather variable in size, colour and sculpture (c.f. figs. 1-5). It does not develop a varix until reaching maturity but, especially in cooler waters, may continue growing and add additional varices on the body whorl. There is usually a characteristic pattern of black spots on the axial ribs, although these are sometimes sparse or absent. Such unicolored forms resemble *digitale* Reeve, 1844 which may also prove to be a synonym.

M. bracteatus is a relatively common species in the Central Indo-Pacific and extends along the eastern Australian coast from central N.S.W. northwards. It also occurs at Lord Howe Island, New Caledonia, Kermadec Islands (Oliver, 1915), and Japan. The Japanese form has been separated as a subspecies, *longus*, but there are no consistent observable differences between Japanese shells and those from other areas. Cernohorsky (1969) does not record this species from Fiji. There are two specimens in the Australian Museum (C. 70621) from Sovi Bay, Viti Levu, Fiji.

Genus *Phrygiomurex* Dall, 1904

Type species: (o.d.) *Triton sculptilis* Reeve, 1844.

This monotypic genus is close to *Maculotriton* in radular features (cf. Text figs. 1: 5, 6, 7) but there are differences in the shell and operculum between the two type species. The shell has deeply channelled sutures and quite different sculpture from that of *Maculotriton*. The protoconch of *sculptilis* is decollated in all specimens seen by the writer so that this is probably a normal habit of the species. *Maculotriton* species retain the protoconch. The operculum is opaque, deep reddish-brown and has a baso-lateral nucleus.

Phrygiomurex sculptilis (Reeve, 1844)

Text fig. 1: 7

1844 *Triton sculptilis* Reeve, *Conch. Icon.* 2, *Triton*, pl. 18, fig. 76.

P. sculptilis is represented in the Australian Museum collections from Bird Islet, Wreck Reef, Queensland (C. 76998), and Angourie, northern N.S.W. (C. 76999) and has an otherwise wide Indo-Pacific distribution. It has not previously been recorded from Australia.

Genus *Aspella* Mörch, 1877

Type species: (monotypy) *Ranella anceps* Lamarck, 1822.

Subgenus *Aspella* s.s.

Hertlein & Strong (1951) have discussed this genus in some considerable detail. Its relationships are rather obscure. It certainly does not

have much in common with *Favartia* Jousseaume, 1880 which is sometimes regarded as a subgenus (Thiele, 1929; Wenz, 1941; Vokes, 1964). Emerson and D'Attilio (1970b) figure the radula and operculum of their *Aspella (Dermomurex) myrakeenae.*

The radula of a specimen of *A. (A.) anceps* from Woolgoolga, N.S.W., is figured (Text fig. 2: 12). It is of the typical muricid pattern with a wide central tooth with 3 main cusps, between which lie two prominent intermediate cusps. The central cusp is largest and there are no accessory denticles. The lateral teeth are simple and normal. The operculum has a terminal nucleus, is yellowish and simple.

Aspella undata Hedley, 1907 belongs to the Turridae (subfamily Mangeliinae), although it does not fit exactly into any of the known genera.

M. Smith (1953) lists "*Aspella australis* Dall Mss. name? Australia" and "*A. ceylonensis* Dall holotype in U. S. N. M. Ceylon". Neither of these names appear to have been published and must be regarded as *nomena nuda.*

Aspella (Aspella) anceps (Lamarck, 1822)

Plate 23, fig. 7; Text fig. 2: 12

1822 *Ranella anceps* Lamarck, *Anim. Sans. Vert.*, 7: 154.
1833 *Ranella pyramidalis* Broderip, *Proc. Comm. Sci. Corres., Zool. Soc. Lond.* (1832), 25: 194.
1835 *Ranella pyramidalis.* Sowerby, *Conch. Illust. (Ranella)*, fig. 2.
1842 *Ranella anceps.* Kiener, *Coq. Viv. (Genre Ranella)*, p. 36, pl. 4, fig. 2.
1844 *Ranella anceps.* Reeve, *Conch. Icon.* 2 *(Ranella)*, pl. 8, fig. 43.
1961 *Aspella (Aspella) anceps.* Warmke & Abbott, *Caribbean Seashells*, p. 108, pl. 19, fig. C.
1964 *Aspella anceps.* Habe, *Shells of the Western Pacific in Colour* 2: 83, pl. 27, fig. 3.

Lamarck's type specimen from unknown locality has apparently not been figured but his brief description and the dimensions he gives suggest that *anceps* is probably the small, smooth species found not uncommonly in N.S.W. and Queensland. Bartsch (1915) has cited the west coast of America as the type locality but Keen (1958) does not record this species.

Hertlein & Strong separate *pyramidalis* Broderip and *anceps,* and Keen (1958) refers to the Central West American species by the former name. Sowerby's figure of Broderip's species shows a shell identical to that of Reeve's and Kiener's figure of *anceps* in that it has only two axial folds between each of the lateral varices and extremely weak spiral sculpture. *Ranella hastula* Reeve, 1844 *(Conch. Icon.* pl. 8, fig. 42) is similar and may be the same species. Probably, with careful examination of good series of material, this species will be split into several geographic forms. One name, *acuticostata* Turton, 1892, is already available for the South African form.

The Australian Museum has specimens of this species from the following localities: Taboga Island, Panama (C. 79035); Lifu, Loyalty Islands (C. 76872, C. 76871, C. 25705); Port of Noumea, New Caledonia (C. 76875); Akamaru, Paumotus (C. 28273); Pearl Harbour, Hawaiian Islands (C. 48227); Torres Strait, N. Qld. (C. 8066); Murray Is., Torres Strait (C. 29555); off Port Darwin, N.T. (C. 76873); Broome, W.A. (C. 68507); Cottesloe, W.A. (C. 10469); Morris Is., Qld. (C. 69481); Masthead

Reef, Qld. (C. 19019); Lindeman Is., Qld. (C. 76870); Wilsons Beach, Wooli, N.S.W. (C. 76874); Woolgoolga, N.S.W. (C. 76023, C. 76671); Port Stephens, N.S.W. (C. 8469); Catherine Hill Bay, N.S.W. (C. 10441); Collaroy Beach, N.S.W. (C. 48844). Warrior Reef, Torres Strait and Katow, New Guinea specimens (recorded by Brazier, 1877) are in the Macleay Museum, Sydney.

Aspella (Aspella) producta (Pease, 1861)

Plate 4, fig. 8

1861 *Ranella producta* Pease, *Proc. Zool. Soc.*: 397.

1958 *Aspella (Aspella) pyramidalis* Keen, *Seashells of Tropical West America*: 364, fig. 376 (not of Broderip).

1965 *Ranella producta*. Kay, *Bull. Brit. Mus. (Nat. Hist.) Zool. Suppl.* 1: 37, pl. 6, figs. 17, 18 (holotype).

Pease's name appears to be the most satisfactory to use for the species figured by Keen (1958) as *pyramidalis*. It differs from *anceps* in its larger shell (up to 20 mm in length) and its much coarser spiral cords which render the 3 axial ribs, lying between the varices, nodulous.

This species, like *anceps*, has a wide distribution: Hawaiian Islands (type); Central West America and Galapagos Islands (Keen, 1958); Mauritius (C. 76876, C. 76877, C. 4960); New Hebrides (C. 76878); Murray Island, Torres Strait (C. 76879); Low Isles, off Port Douglas, Queensland (C. 76881); Michaelmas Cay, Queensland (C. 76880); Palm Island, Queensland (C. 9653).

Genus *Favartia* Jousseaume, 1880

Type species: (o.d.) *Murex breviculus* Sowerby, 1834.

Subgenus *Favartia* s.s.

Although some authors (see above) regard *Favartia* as a subgenus of *Aspella*, Cernohorsky (1967) gave it full generic status and described the operculum of the type species. *F. brevicula* has very different shell features and a different radula (Text fig. 2: 21) from those of *Aspella*. The opportunity is taken to figure the radula of the common Florida-West Indian *F. cellulosa* (Conrad, 1846) for comparison with the type species (Text fig. 2: 22).

In the North American group *Maxwellia* Baily, 1950 (type species (o.d.) *Murex gemma* Sowerby, 1879) which contains at least one other species *(M. santarosana* Dall, 1905) apart from the type, the shell and opercular features are very similar to those of *Favartia* species. The operculum has become thickened throughout and the concentric ridges are even more conspicuous. *Maxwellia* could probably be regarded as a subgenus of *Favartia*, and although the radula of neither of the species has been described, Vokes (1970a) states that it is identical in both species. She also notes the resemblance of *Maxwellia* to *Murexiella* (see below) and *Favartia*.

F. (F.) tetragona (Broderip, 1833) was recorded from Bet Island, Torres Strait in 11 fathoms by Brazier (1877) but his specimen has been lost and thus this record cannot be confirmed.

Favartia (Favartia) brevicula (Sowerby, 1834)

Plate 22, fig. 1; Text fig. 2: 21

1834 *Murex breviculus* Sowerby, *Conch. Illust.*, Murex, fig. 37.
1967 *Favartia brevicula*. Cernohorsky; *Veliger*, 10 (2): 126, pl. 15, fig. 19, text fig. 8.

The operculum of *F. (F.) brevicula* is rather distinctive. It has the lateral borders thinner than the remainder. These borders are sometimes yellowish, becoming, with maturity, red-brown and thickened like the remainder of the operculum. The surface is relatively strongly concentrically ridged and the nucleus is terminal, although the thinner borders make the otherwise leaf-shaped operculum almost circular (Text fig. 4: 35).

F. (F.) brevicula is represented in the Australian Museum collections from Murray Island, Torres Strait (C. 29465); Lady Elliot Island, Queensland (C. 69172); Hazelwood Island, Whitsunday Passage, Queensland (C. 77287); Reef off Kurrimine Beach, near Silkwood, Queensland (C. 79036); and "north west Australia" (exact locality unknown) (C. 49711), as well as specimens from other Indo-Pacific localities.

Favartia (Favartia) confusa (Brazier, 1877)

Plate 22, fig. 5; Text fig. 2: 20a, b

1877 *Murex (Ocinebra) confusa* Brazier, *Proc. Linn. Soc. N.S.W.*, 1: 172.
1901 *Murex confusus*. Hedley, *Rec. Aust. Mus.*, 4: 123, pl. 16, fig. 4.

F. (F.) confusa is a typical *Favartia*, its radula (Text fig. 2: 20a, b) being similar to that of *brevicula*. The operculum is also like that of *brevicula* except that the borders are narrower so that the operculum is more narrowly oval than in *brevicula*, but otherwise they are very similar.

This species is represented by only three specimens in the Australian Museum, one being the holotype (C. 77183) from 55 metres, Darnley Island, Torres Strait. The other specimens are from 9-15 metres, Murray Island, Torres Strait (C. 29965) and Caloundra, Queensland (C. 79037).

Subgenus *Subpterynotus* Olsson and Harbison, 1953

Type species: (o.d.) *Murex textilis* Gabb, 1873.

This subgenus has been discussed by Vokes (1968) in detail. The type species is a Floridian to central American Miocene-Pliocene fossil.

Vokes recognised only one Recent species, *Murex exquisitus* Sowerby, 1904 as a *Subpterynotus*. Sowerby's species was described from unknown habitat and apparently has not been recollected.

The South Australian species *Murex tatei* Verco, 1895 and its Pliocene fore-runner *Homalocantha antecedens* Ludbrook, 1957 appear to be two further species of *Subpterynotus*.

Vokes (1964) made *Subpterynotus* a synonym of *Pterynotus* but later (1968) used it as a subgenus of *Murexiella*. The group seems to be closely related to *Murexiella* and *Favartia* and is retained as a subgenus pending further information. The radula of *F. (S.) tatei* has not been seen but the operculum is like that of *Favartia* and *Murexiella*, being deep red, with prominent external growth ridges and with a terminal nucleus.

Subgenus *Murexiella* Clench and Farfante, 1945

Type species: (o.d.) *Murex hidalgoi* Crosse, 1869.
Synonym: *Minnimurex* Woolacott, 1957, type species: (o.d.) *Minnimurex phantom* Woolacott, 1957.

Murexiella resembles, in many ways, *Favartia*, but some species produce spines and the shells of most species are smaller, lighter in build and more delicately sculptured. Shell features are not consistently different in species ascribed to both groups and because of the similarity in radular structure and opercular features, *Murexiella* can be regarded, at best, as being only subgenerically distinct from *Favartia*.

Vokes (1968, 1970a) discusses the characteristics of this group in detail and she (1968) and Emerson and D'Attilio (1970a) illustrate the radula of the type species which lives in deepwater off the Lesser Antilles. The distinctive features of the genus according to Vokes (1970a) are the "almost circular aperture with no anal notch and from 4 to 10 foliaceous varices, which have the fronds connected by a complex laminated webbing". The type species has long spines but in many closely related forms these spines are short or rudimentary and the varices rather heavy.

This subgenus appears to be rather wide-spread but many of the species that probably fall within this group have not yet been formally included in it. One such species is *Murex pumillus* A. Adams, 1854, from Mauritius which is figured (Plate 22, fig. 10) for comparison with *F. (M.) salmonea* (Melvill and Standen) which it somewhat resembles. The radula from this specimen is also figured (Text fig. 2: 13).

Favartia (Murexiella) salmonea (Melvill and Standen, 1899)

Plate 21, figs. 1, 2; Text fig. 1: 10

1899 *Murex (Ocinebra) salmoneus* Melvill and Standen, *J. Linn. Soc. Zool.*, 27: 162, pl. 10, fig. 2.

This species is characterised by its relatively thick shell, pink colour, heavy varices (5-6 per whorl) and 7-11 (usually 8) spiral cords on the body whorl and base. The small protoconch has $2\frac{1}{2}$ whorls.

Height:	12.5 mm.	Diameter:	6.0 mm. (holotype).
	12.90 mm.		7.85 mm. (Swain Reefs)
	12.80 mm.		7.40 mm. (Torres Strait)

The radula of a specimen from Torres Strait (Text fig. 1: 10) has relatively deep central teeth which have a short, strong median cusp located above the two pairs of lateral cusps. The lateral teeth are relatively small. This radula is very like that of *Murexiella hidalgoi* (Crosse) illustrated by Emerson and D'Attilio (1970). The operculum of the same specimen is red-brown, oval, with wide non-thickened, yellowish lateral borders, a terminal nucleus and distinct growth lines.

Localities: 9-15 metres, Murray Is., Torres Strait (C. 29961); 64-73 metres, off Gillett Cay, Swain Reefs, Queensland (C. 77193).

Remarks: Melvill and Standen described this species from Torres Strait and the type (in the British Museum) is narrower than the specimens in the Australian Museum but these do not appear to differ in other ways. Specimens in the Australian Museum collection labelled *salmonea* by Hedley are mostly a new species described below.

Favartia (Murexiella) voorwindei sp. nov.

Plate 21, fig. 4.

Shell: Small, rather lightly built, with thin, flaring varices, short spire and broad body whorl. Protoconch rather large, of 1½ whorls, the tip bulbous and strongly tilted. Teleoconch of 4¾ strongly convex whorls, with 2 prominent spiral cords and 6-7 (usually 7) varices per whorl; fewer on the body whorl (5-6). Varices delicate, rather thin when not worn, with short, curved, hollow spines on their edges. Lattice-like sculpture lies between the variceal ribs on the ventral face of each varix. Delicate laminate axials and very minute spiral striae make up the minor sculpture. 7 spirals on body whorl and base, lower 2 just above a conspicuous fasciole. There are no secondary ribs in the rather wide interstices but an extremely weak secondary spine is sometimes found between primary spines on the varices. Anterior canal moderately long, somewhat curved dorsally, narrowly open. Aperture small, with inner lip raised, smooth. Outer lip with shallow grooves running into the aperture which correspond to the external spiral ribs. Colour white (all specimens dead).

Dimensions: Height: 10.75 mm. Diameter: 6.94 mm. (holotype)
9.26 mm. 6.00 mm. (paratype)

Locality: 64-73 metres off Gillett Cay, Swain Reefs, Queensland. Collected by Australian Museum Swain Reefs Expedition, Oct. 1962, (C. 77194) holotype and 8 paratypes (C. 77195).

The new species is closest to *salmonea* from which it differs in its fewer, thinner varices (8 on spire whorl in *salmonea*, 6-7 (usually 7) in *voorwindei*), lighter build, shorter spire and hence relatively broader shell, and different protoconch — *salmonea* has 2½ whorls, *voorwindei* has 1½. The spiral cords are often bifid or trifid in *salmonea* whereas they are simple (single) in *voorwindei* and a small secondary spiral (which forms a weak variceal spine) is seen in the former species. In addition *salmonea* has the anterior canal turned dorsally, more sharply. Two specimens of *salmonea* were found in the same dredging as *voorwindei*, showing that the two species are not ecotypic forms.

The new species is named for Mr. Jacques Voorwinde, an honorary member of the Department of Malacology of the Australian Museum. Mr. Voorwinde tirelessly sorted the Swain Reefs dredgings, although this is but a minor part of his total contribution.

PLATE 21.

1, 2. *Favartia (Murexiella) salmoneus* (Melvill and Standen). 1 — 64 - 73 metres off Gillett Cay, Swain Reefs, Queensland (C. 77193); 2 — 9 - 15 metres, Murray Island, Torres Strait (C. 29961). *

3. *Favartia (Murexiella) iredalei* sp. nov. Lord Howe Island, holotype (C. 77180).

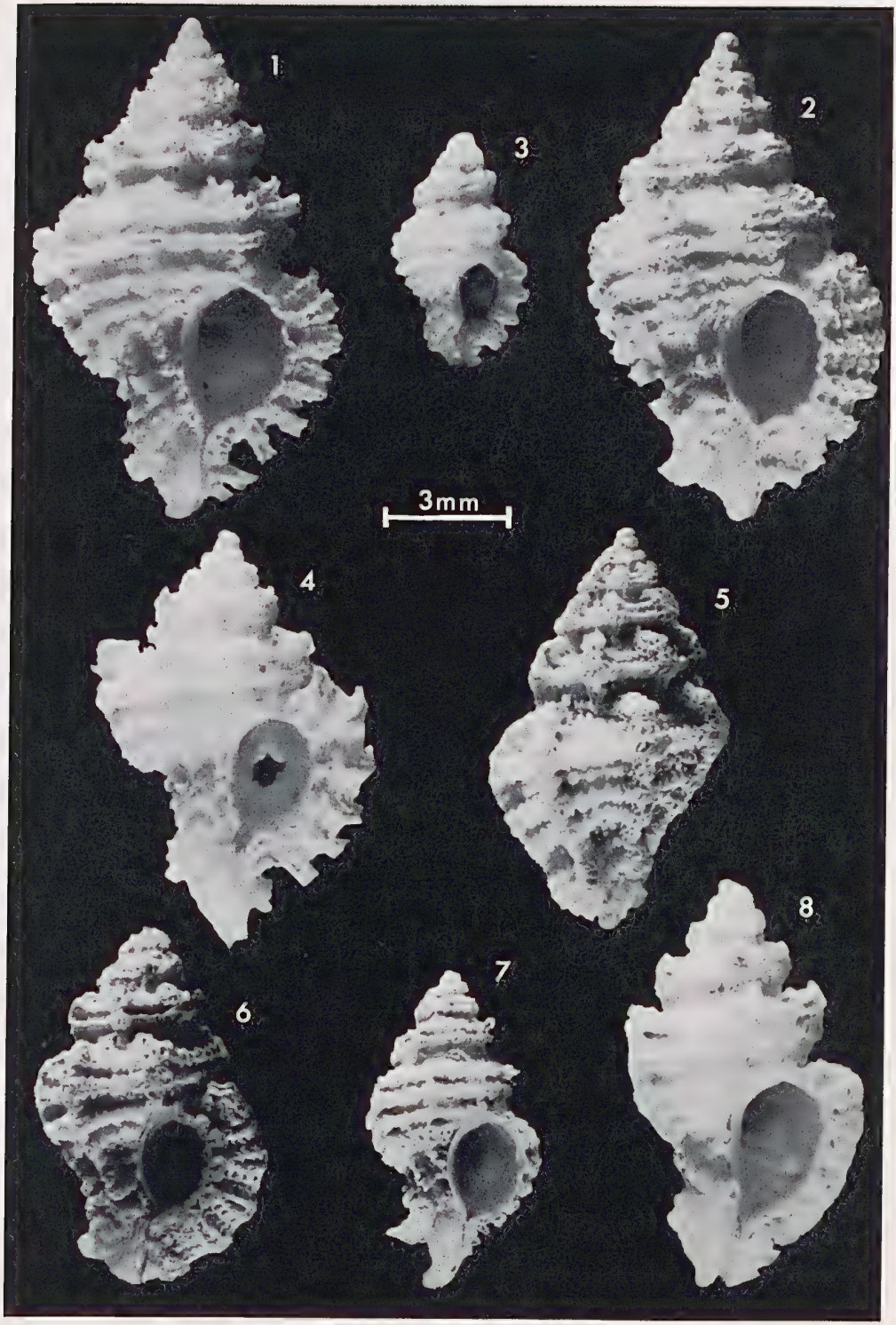
4. *Favartia (Murexiella) voorwindei* sp. nov. 64 - 73 metres off Gillett Cay, Swain Reefs, Queensland, holotype (C. 77194).

5, 6. *Favartia (Murexiella) striasquamosa* sp. nov. Lindeman Island, Queensland: 5 — holotype (C. 77190) *; 6 — paratype (C. 76670).

7. *Favartia (Murexiella) brazieri* (Angas). Sydney, N.S.W. (C. 59).

8. *Favartia (Murexiella) phantom* (Woolacott). Gerringong, N.S.W., holotype (C. 77171).

All to same scale.
* Specimens from which figured radulae obtained.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Favartia (Murexiella) striasquamosa sp. nov.

Plate 21, figs. 5, 6; Text fig. 1: 11

1877 *Murex (Muricidea) mundus* Brazier, *Proc. Linn. Soc. N.S.W.*, 1: 172 (not of Reeve).

Shell: Small, solid, with rounded, heavy varices. Protoconch minute, of 1½ whorls, tip small, slightly tilted. Teleoconch of approximately 5 convex whorls. 2 strong spiral cords per whorl with 4 additional cords on body whorl and base. Upper spiral sometimes weaker than lower one on spire whorl. Weak intermediate threads lie above and below the sutures on the penultimate whorl, these continuing on to the body whorl which also has 2 threads between the 4th and 5th spiral cords on the base. Axial sculpture of numerous, weak, foliose threads, which are produced into prominent scales on the spiral cords. The scales are flattened so that they lie horizontal to the shell surface and each is individually sculptured with numerous (up to 18) spirally orientated, somewhat irregular, slightly radiating threads. There are approximately 5-7 scales between each varix on the body whorl with 7 varices per whorl on spire whorls and 6 on body whorl. A number of closely packed, wavy axial lamellae give a lattice-like effect between the spiral ribs; these ribs do not form spines. Aperture small, with a rather short, almost closed anterior canal which is sharply twisted dorsally. Colour greyish or yellowish-white, with purplish blotches in the aperture and between the spiral ribs.

Operculum: Oval, yellowish-brown, with distinct concentric growth lines, and wide, non-thickened borders laterally. Nucleus subterminal.

Radula: Central teeth relatively deep, with the strong but short median cusp held higher than the other 4 cusps. Lateral tooth relatively small (Text fig. 1: 11). Very like the radula of *salmonea*.

Dimensions: Height: 10.24 mm. Diameter: 5.90 mm. (holotype)
9.37 mm. 5.66 mm. (figured paratype)

Locality: Lindeman Island, Queensland. Collected M. Ward (C. 77190 holotype, C. 77192 figured paratype, C. 77191 2 additional paratypes).

Additional Material Examined: Lizard Island, south east of Howick Group, Queensland. C. Hedley (C. 41341); Low Isles, near Port Douglas, Queensland. Great Barrier Reef Exped., 1929. T. Iredale (C. 77279); Rocky Isle, 25 miles north east of Cape Flattery, Queensland (C. 76944); outer Barrier Reef, S. Lat. 14, Queensland. C. Hedley (C. 76943); 9-15 metres, Murray Island, Torres Strait. C. Hedley (C. 76942); Torres Strait, 22 metres. J. Brazier (C. 8068); Darnley Island, Torres Strait, 55 metres, Chevert Exped. (Macleay Museum) (Brazier's record of *mundus*); Kapa Kapa, S. E. of Port Moresby, Papua, on sheltered coral flats, low tide. W. F. Ponder and P. H. Colman (C. 80093).

This species is readily separated from *salmonea* and *voorwindei* by the flattened scale-like lamellae, smaller shell, and coloration (*salmonea* is pink). Both *voorwindei* and *salmonea* have simple irregular lamellae which form simple, fragile, upright foliations. In all cases these lamellae, scales etc. are easily worn off. The varices are like those of *salmonea* in general form but the protoconch, although smaller, has the same number of whorls as that of *voorwindei*. *Murex mundus* Reeve, 1845 is larger and has an additional spiral cord on the body whorl. It is not known what the minor sculpture of this species from the Philippines is.

Favartia (Murexiella) phantom (Woolacott, 1957)

Plate 21, fig. 8

1957 *Minnimurex phantom* Woolacott, *Proc. Roy. Zool. Soc. N.S.W.* 1955 - 56: 115, pl. 3, fig. 8.

This species is the type of *Minnimurex* which has been placed in the synonymy of *Murexiella* by Vokes (1964) because of the resemblance of *M. phantom* to the central American species *M. humilis* (Broderip, 1833) and *M. macgintyi* (M. Smith, 1938). Comparison of figures of these species with specimens of *phantom* show some features in common but *phantom* has weaker and fewer varices (only 4 per whorl), a short, open anterior canal and appears to lack variceal spines. Only dead, worn specimens were available for examination.

Localities: Gerringong, N.S.W. (C. 77171) (holotype); Angourie, northern N.S.W. (C. 77280); Catherine Hill Bay, s. of Swansea, N.S.W. (C. 58577); Long Reef, Collaroy, N.S.W. (C. 79038).

Favartia (Murexiella) brazieri (Angas, 1877)

Plate 21, fig. 7; Text fig. 1: 9

1877 *Murex brazieri* Angas, *Proc. Zool. Soc.* (1877): 171, pl. 26, fig. 3.
(1884 *Trophon tumidus* Petterd, *J. Conch., Lond.*, 4: 141).
1962 *Murexsul brazieri*. Macpherson and Gabriel, *Mar. Molluscs Vict.*: 169, fig. 201.

Brazier (1893a; b) has given a detailed synonymy of this species. I have not seen the type specimen of *T. tumidus* Petterd, nor has it been figured, so that this species is tentatively included in the synonymy of *brazieri* on Brazier's authority. The dimensions given by Petterd (12 x 8 mm) are greater than those of any specimen of *brazieri* seen by the writer, the largest examined being 10.5 x 6.7 mm from Bunbury, W. Aust. (C. 37260).

This species has 2 strong, often bifid spiral cords on the spire whorls and 10-13 spiral cords on the body whorl and base. There are 6-7 varices on the body whorl, these being thickened, low, rounded and closely resembling axial ribs. The axial sculpture is lamellate, giving a scaly appearance to the shell which is easily worn off. The protoconch has about $2\frac{1}{4}$ smooth, lightly convex whorls and is reddish-purple in colour.

The operculum is typical, reddish-brown, with a terminal nucleus.

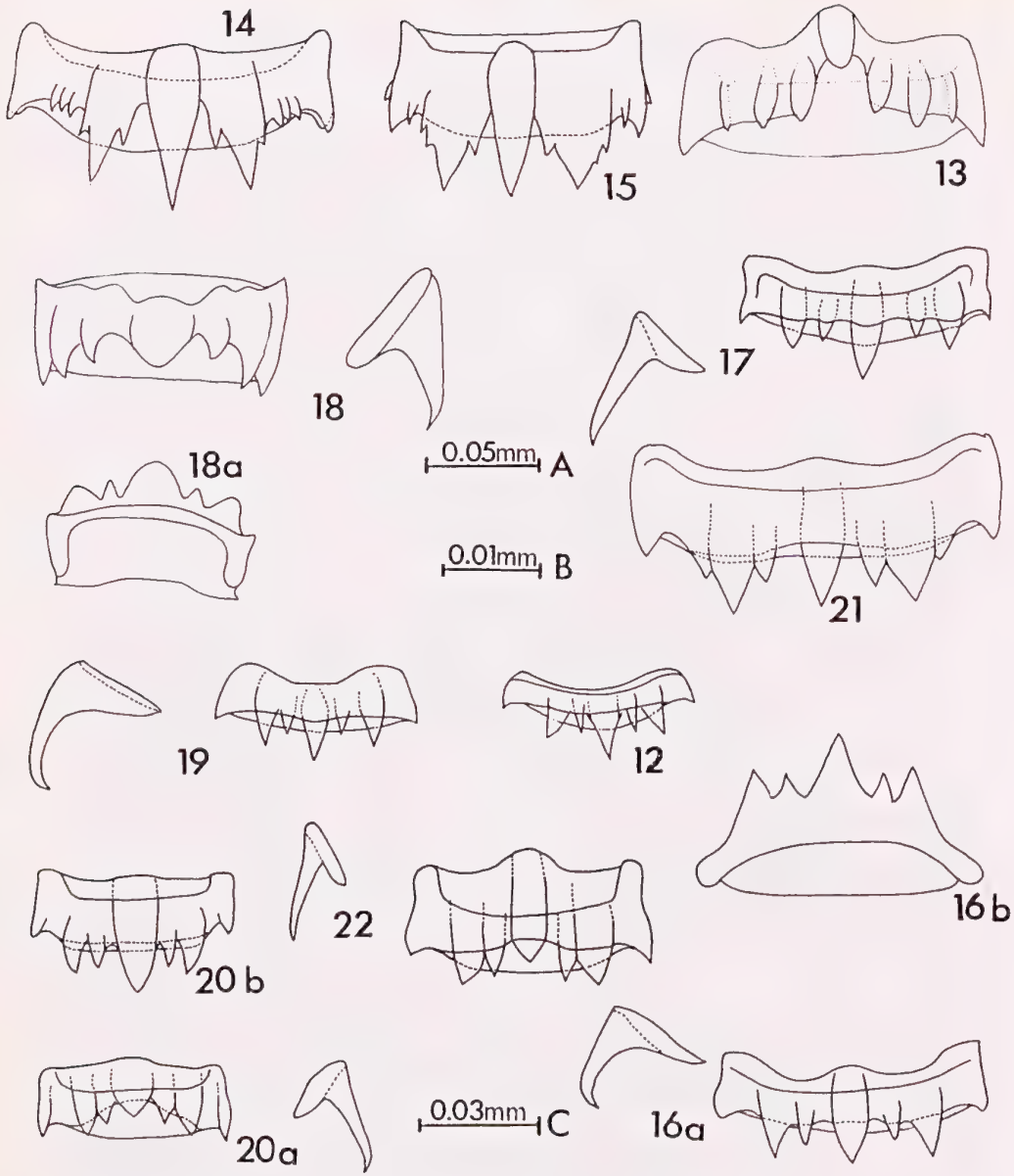
The radula (Text fig. 1: 9) is similar to that of *salmonea* and *striasquamosa* except that there are a pair of small denticles on the outerside of the outermost cusps of the central teeth.

Range: Caoundra, southern Queensland (C. 77281) along the N.S.W. coast, southern Australia and Tasmania to mid Western Australia, at least as far north as Perth (C. 10458).

Favartia (Murexiella) iredalei sp. nov.

Plate 21, fig. 3

Shell: Small, pinkish, with strong spiral cords crossing 8-9 varices and inconspicuous secondary sculpture. Protoconch (from paratypes) of $1\frac{1}{2}$ strongly deviated whorls. Teleoconch of about 4 whorls, varices on



TEXT FIG. 2. Radular teeth.

12. *Aspella (Aspella) anceps* (Lamarck). Woolgoolga, N.S.W. (C. 76671).
13. *Favartia (Murexiella) pumila* (A. Adams). Mauritius (C. 36013).
14. *Pteropurpura festiva* (Hinds). San Pedro, California (C. 76589).
15. *Pteropurpura (Ocinebrellus) falcatus* (Sowerby). Kii, Japan (C. 66915).
16. *Pterotyphis (Prototyphis) angasi angasi* (Crosse). Camp Cove, Sydney, N.S.W. (C. 77139).
17. *Pterotyphis (Prototyphis) zelandicus iredalei* (Fleming). Norfolk Island (C. 59391).
18. *Pterotyphis (Tripterotyphis) lowei norfolkensis* (Fleming). Norfolk Island (C. 59390).
19. *Typhis (Typhina) philippensis interpres* (Iredale). 92 metres off Montague Island, N.S.W. (C. 66931).

20a, b. *Favartia (Favartia) confusa* (Brazier). 9 - 15 metres, Torres Strait (C. 29965).

21. *Favartia (Favartia) brevicula* (Sowerby). New Caledonia (C. 36409).
22. *Favartia (Favartia) cellulosa* (Conrad). Bonefish Key, Florida. (C. 77267).

Scale A: fig. 14 - 15; Scale B: fig. 18; Scale C: fig. 12 - 13, 16 - 17, 19 - 22.

1st whorl extending on to last whorl of protoconch as thin lamellae. 6-8 (8 in holotype) varices on body whorl, 9 on penultimate whorl. Last 1-2 varices stronger (in adults) than rest, and these exhibit webbing between the spiral ribs. Spire whorls with 2 spirals, and a suprasutural cord on the penultimate whorl. 5 spirals on body whorl, uppermost forming a distinctive shoulder, upper 2 strongest and usually bifid on last 1½ whorls. A very weak 6th spiral and a strong 7th lies between the very prominent fasciole and the last basal spiral. A single, short, scale-like spine is formed at each point of intersection with the varices on the lower whorls, sharp nodules being produced on the upper spire whorls. Intervariceal sculpture of fine axial threads, which are very easily worn off. Aperture rounded, canal open (probably closed in well preserved, mature specimens) curved a little dorsally, otherwise straight. Outer lip grooved within, grooves corresponding to the spiral ribs. Inner lip smooth. Colour yellowish-pink, varices and spiral cords paler than remainder of surface.

Dimensions: Height: 6.20 mm. Diameter: 3.52 mm. (holotype)
7.30 mm. 4.10 mm. (paratype)

Locality: Lord Howe Island, R. Bell, holotype (C. 77180) and 7 paratypes (C. 77181).

All the mature specimens were rather worn. This species appears to be related to *Hexaplex puniceus* Oliver, 1915 from the Kermadec Islands, but Oliver's description and figure show only 4 spiral cords on the body whorl which apparently form nodules on all whorls. It is possible that these two forms may eventually be found to be only subspecifically distinct. *F. (M.) brazieri* is of similar size but has purplish-coloured variceal ribs, a different protoconch and the secondary sculpture is much more scaly. The other species described herein also differ in having better developed secondary sculpture.

This species is named in honour of Mr. Tom Iredale, who was Curator of Molluscs at the Australian Museum from 1924 to 1944. Since his retirement he has, until recently, been actively involved in the Mollusc Department, and is still working with shells at his home in Harbord, Sydney. He turned 91 on the 24th March, 1971.

Genus *Muricopsis* Bucquoy, Dautzenberg & Dollfus, 1882

Type species: (o.d.) *Murex blainvillei* Payraudeau, 1862 (replacement name for *Muricidea* Mörch, 1852, non Swainson, 1840).

Synonym: *Murexsul* Iredale, 1915, type species: (o.d.) *Murex octogonus* Quoy & Gaimard, 1833.

Subgenus *Muricopsis* s.s.

Vokes (1964) commented that " shells of *Muricopsis* are not unlike those of the Australian *Murexsul* group. They may be distinguished by the extreme development of the denticles on the outer lip of *Muricopsis* ". However, all of the Australian species examined by the writer have denticles developed inside the inner lip so that this distinction is not valid. A specimen of *M. blainvillei* is figured (Plate 22, fig. 4) for comparison with the Australian species.

The placement by Vokes (1964, 1968) of *Murexsul* as a subgenus of *Hexaplex* cannot be maintained owing to the very different radulae in both groups. The radula of *octogonus* figured by Ponder (1968),

showed the central tooth flattened. The cusps are normally curved over the basal plate (Text fig. 3: 24) and the radula strongly resembles that of *Muricopsis blainvillei* (Text fig. 3: 23) also figured by Radwin and D'Attilio (1970) and Troschel and Thiele (1869).

The radulae of the Australian species of *Muricopsis* are figured for comparison (Text fig. 3) and all are noticeably similar. The protoconch of all examined species is paucispiral, strongly tilted and often keeled. A specimen of *M. blainvillei* with an intact protoconch was not available to the writer. The protoconch of *M. octogonus* is figured by Ponder (1968). The operculae of all examined species are red-brown with a nucleus that tends to become subterminal, that of *M. octogonus octogonus* being shown in (Text fig. 4: 31). Radwin and D'Attilio (1970) figure the operculum of *blainvillei* and *jaliscoensis* Radwin and D'Attilio, 1970. In both of these they show a peculiar process emerging from the inner side of a lateral thickening into the muscle-impression area. This structure is actually a slight irregularity in the edge of the thickening in the two specimens of *blainvillei* examined and is certainly not of any taxonomic significance. Vokes (1968) has stated that the muscle attachment area of the operculum of *M. octogonus* is " entirely different in construction " from that of *Tritonalia*. I can see no differences between the opercula of members of the Ocenebrinae and of the Muricinae apart from the position of the nucleus. Both groups exhibit the same type of muscle attachment area (cf. Text fig. 4: 30-35).

In view of the close similarities in the radula, operculum, protoconch and teleoconch features in species assigned to *Murexsul* and *Muricopsis* there can be little doubt that *Murexsul* can be regarded as a junior synonym of *Muricopsis*.

Vokes (1970a) suggested that *Murexsul* and *Murexiella* intergrade but there appear to be sufficient features separating the two groups to give *Muricopsis* full generic status. Such features include the open anterior canal into which the aperture gradually constricts, the relatively simple, numerous varices and spines and tall spire. The operculum is also rather different from that of *Murexiella* in lacking the broad, non-thickened lateral areas. Although the central teeth of the radulae are similar, the central cusp is situated somewhat higher on the tooth in top view in *Murexiella* and *Favartia* s.s. than in *Muricopsis*. In addition the lateral teeth are relatively smaller in *Murexiella*.

Murexsul conatus McMichael, 1964 is not a *Muricopsis* but can be included in the genus *Hexaplex* Perry, 1810, as far as can be judged on shell features.

Muricopsis (Muricopsis) octogonus umbilicatus (T. - Woods, 1876)

Plate 22, fig. 3, Text fig. 3: 25

1854 *Murex scalaris* A. Adams, *Proc. Zool. Soc.*, 21 (1853): 71 (non Brocchi, 1814).

1865 *Murex scalaris*. Angas, *Proc. Zool. Soc.*, (1865): 157.

(1865 *Murex serotinus* Angas, *Proc. Zool. Soc.*, (1863): 157 (not of A. Adams)).

1876 *Trophon umbilicatus* T.-Woods, *Proc. R. Soc. Tasm.*, (1875): 135

1880 *Murex (Phyllonotus) angasi* Tryon, *Manual of Conchology*, 2: 109 (nom. nov. pro *Murex scalaris* A. Adams, non Brocchi, 1814).

1880 *Urosalpinx umbilicata*. Tryon, *Manual of Conchology*, 2: 155.

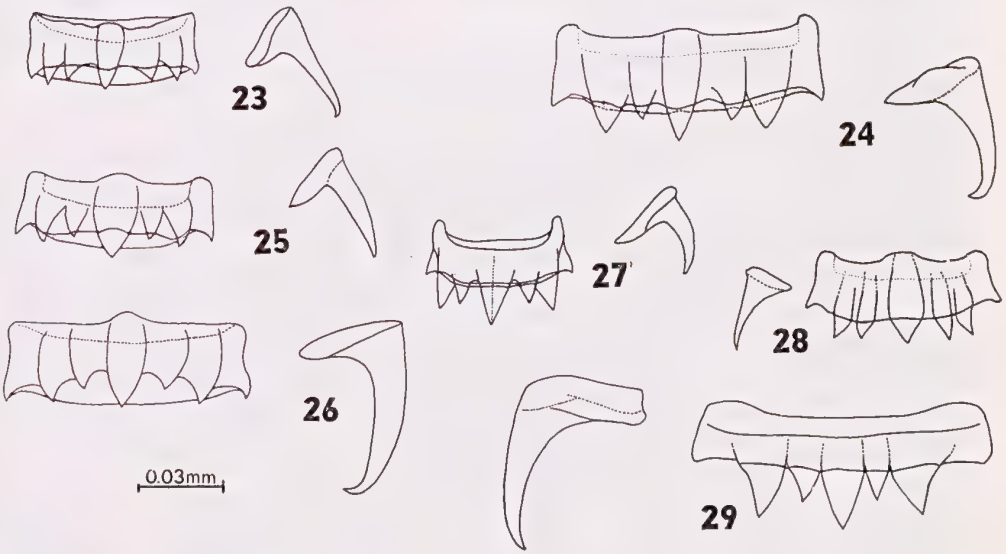
1886 *Murex (Phyllonotus) octogonus* Bednall, *Trans. R. Soc. S. Aust.*, 8 (1884, 1885): 64 (not of Quoy and Gaimard).

1893 *Murex umbilicatus*. Brazier, *Cat. Mar. Shells Aust.*: 64 (full synonymy).

1895 *Murex umbilicatus*. Verco, *Trans. R. Soc. S. Aust.*, 19: 96.
1896 *Murex umbilicatus*. Verco, *Trans. R. Soc. S. Aust.*, 20: 231. pl. 7, figs. 4, a - c.
1962 *Murexsul umbilicatus*. Macpherson and Gabriel, *Mar. Molluscs Vict.*: 169, fig. 202.

A brief synonymy of this subspecies is given because of its complex history. *M. scalaris* A. Adams was described from Moreton Bay (F. Strange) but this was obviously a wrong location as *umbilicatus* does not occur on the East Coast of Australia at all. The type of *scalaris* was examined in the British Museum by Hedley, who confirms in his unpublished notes (2/10/1912) the synonymy already given by Brazier (1893a).

Suter (1901) outlines the history of the published comments on the relationships of *umbilicatus* and *octogonus*. He summarizes his views as follows " After comparing a good many examples from Hauraki Gulf (N.Z.), and also a few from South Australia, I have come to the conclusion that *M. umbilicatus*, T. Woods, is absolutely nothing more than a *variety* of *M. octogonus*, Q. and G." He goes on to discuss the variation in size and sculpture in the two forms and shows that no significant measurable differences could be found. There are, however, differences between Australian and New Zealand specimens which suggest that the two forms are best regarded as subspecies. The umbilical depression is



TEXT FIG. 3. Radular teeth.

23. *Muricopsis (Muricopsis) blainvillei* (Payraudeau). Grand Harbour, Malta, Mediterranean (C. 44572).
24. *Muricopsis (Muricopsis) octogonus octogonus* (Quoy and Gaimard). Westmere Reef, Auckland, New Zealand (Dominion Museum).
25. *Muricopsis (Muricopsis) octogonus umbilicatus* (T. - Woods). Giles Point, near Coobowie, St. Vincent Gulf, South Australia (C. 76256).
26. *Muricopsis (Muricopsis) cuspidatus* (Sowerby). Tryon Island, Capricorn Group, Queensland (C. 77561).
27. *Muricopsis (Muricopsis) planiliratus* (Reeve). St. Francis Island, St. Vincent Gulf, S. Australia (C. 41851).
28. *Muricopsis (Muricopsis) purpurispina* sp. nov. Minnie Waters, Clarence River, N.S.W., holotype (C. 76796).
29. *Muricopsis (Spinidrupa)* cf. *nodulifera* (Sowerby). New Caledonia (C. 36413).

All figures same scale.

usually more pronounced in the Australian shells, and these specimens *usually* have heavier spiral cords and hence more solid, although short, spines. In addition the spiral sculpture is clearly divided into primary and secondary spiral cords. This division is seen in New Zealand specimens obtained from the continental shelf (Ponder, 1968) but littoral shells have the spiral ribs more or less equally developed so that there are more spines on the varices. In addition the denticles within the aperture are generally more strongly developed in the Australian form. These differences, although not always constant, usually allow for the separation of Australian and New Zealand shells. The operculae and radulae (Text fig. 3: 24, 25) are also very similar.

M. (M.) octogonus umbilicatus has been reported from the north coast of Tasmania, western Victoria (probably not east of Wilson's Promontory), and eastern South Australia.

Muricopsis (Muricopsis) planilirata (Reeve, 1845)

Plate 22, fig. 9; Text fig. 3: 27

1822 *Murex fimbriatus* Lamarck, *Anim. S. Vert.*, 7: 176 (non Lightfoot, 1876, non Brocchi, 1814).
1843 *Fusus pallidus* Menke, *Moll. Nov. Holl. Spec.*: 26 (not of Broderip, 1832).
1845 *Murex planiliratus* Reeve, *Conch. Icon.*, 3: pl. 31, fig. 149.
1865 *Murex pumilis* Angas, *Proc. Zool. Soc.*: 158 (not of A. Adams).
1894 *Murex (Pseudomurex) polypleurus* Brazier, *Proc. Linn. Soc. N.S.W.* (2), 7: 179, text figure.

The name *fimbriatus* Lamarck was re-introduced by Hedley (1913) after examining Lamarck's types. Iredale (1916) pointed out that *fimbriatus* Solander (i.e. Lightfoot) invalidates *fimbriatus* Lamarck and Gatliff and Gabriel (1922) re-introduced *planiliratus* Reeve in their catalogue of the Victorian Mollusca. However other Australian writers, including Macpherson and Chapple (1951), Macpherson and Gabriel (1962) and Cotton (1959) continued to use *fimbriatus*. Rehder (1967) has shown that *Murex fimbriatus* Lightfoot = *Trophon geversianus* (Pallus, 1774) and that another prior homonym, *Murex fimbriatus* Brocchi, 1814 is an unidentified species of *Pleuroploca*. The next available name, one that was in regular use until 1913, is *Murex planiliratus* Reeve.

This species somewhat resembles a coralliophilid with its pinkish-white colour, rather delicate, minute scales and short anterior canal. The radular (Text fig. 3: 27) and opercular features are similar to those of other species of *Muricopsis* (s.s.). The protoconch is paucispiral and its $1\frac{3}{4}$ whorls are rather sharply angled.

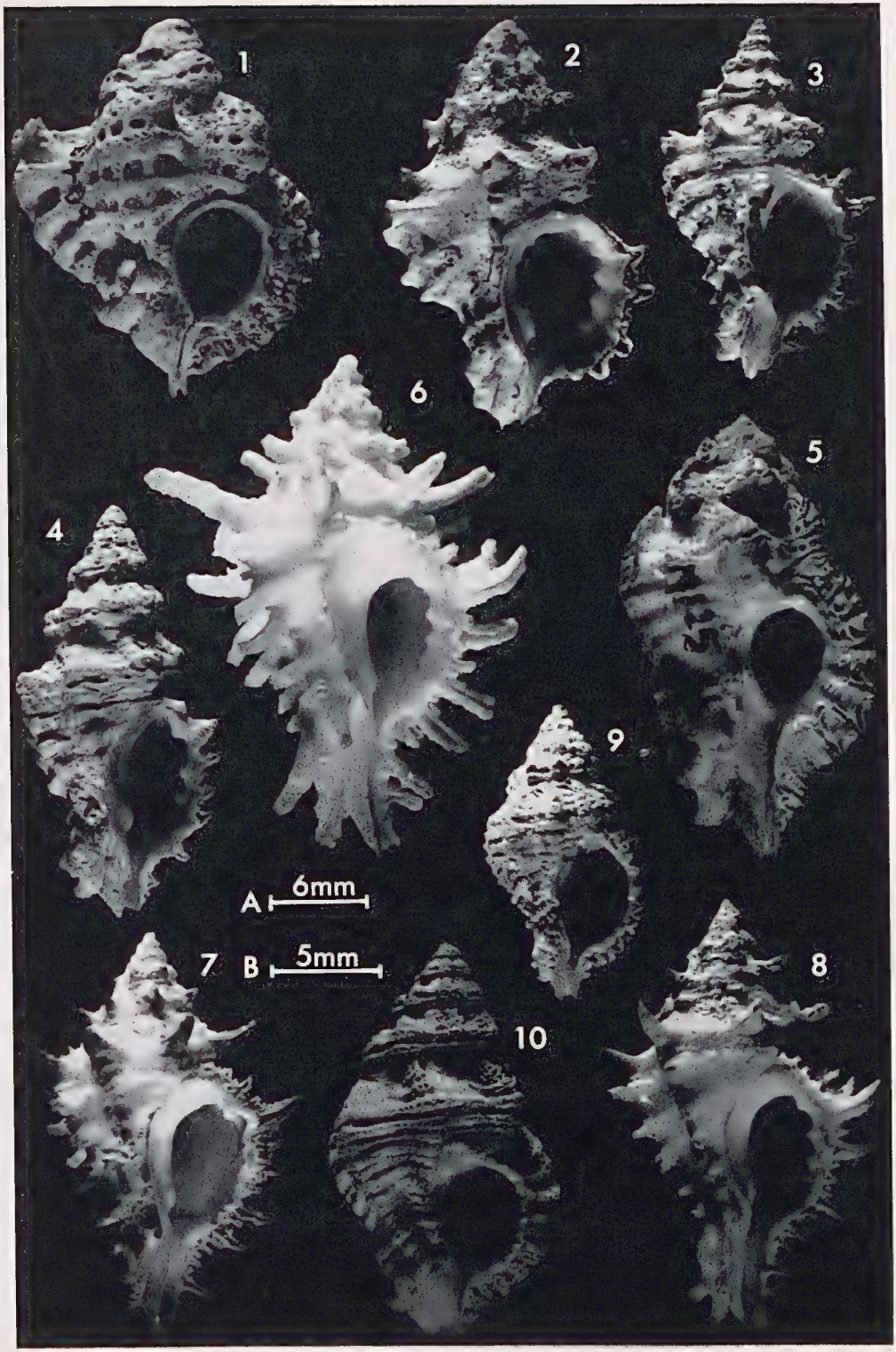
M. (M.) planilirata is distributed around the southern coast of Australia from West of Wilson's Promontory to at least as far north as Perth on the west coast. It has not been recorded from Tasmania.

PLATE 22.

1. *Favartia (Favartia) brevicula* (Sowerby). New Caledonia (C. 36409). *
2. *Muricopsis (Spinidrupa)* cf. *nodulifera* (Sowerby). New Caledonia (C. 36413). *
3. *Muricopsis (Muricopsis) octogonus umbilicatus* (T. - Woods). Giles Point, near Coobowie, St. Vincent Gulf, South Australia (C. 76256). *
4. *Muricopsis (Muricopsis) blainvillei* (Payraudeau). Grand Harbour, Malta (C. 44572). *
5. *Favartia (Favartia) confusa* (Brazier). 55 metres, Darnley Island, Torres Strait, holotype (C. 77183).
6 - 8. *Muricopsis (Muricopsis) cuspidatus* (Sowerby). 6 — 9 metres, Swain Reefs, Queensland (C. 77185); 7 — New Caledonia (C. 77184); 8 — 20 miles north of Herald Prong, No. 1 Reef, Swain Reefs, Queensland (C. 77186).
9. *Muricopsis (Muricopsis) planiliratus* (Reeve). St. Francis Island, St. Vincent Gulf, South Australia (C. 41851). *
10. Favartia *(Muricopsis) pumilla* (A. Adams). Mauritius (C. 36013). *

Scale A: fig. 1 - 8, 10; Scale B: fig. 9.

* Specimens from which figured radulae obtained.


1
2
3
6
5
4
9
A 6mm
7 B 5mm
8
10

Muricopsis (Muricopsis) cuspidatus (Sowerby, 1879)

Plate 22, figs. 6-8; Text fig. 3: 26

1879 *Murex cuspidatus* Sowerby, *Thes. Conch.*: 36, pl. 21, fig. 203.

This species does not appear to have been re-discovered in Japan since its original description and I cannot find any discussion on it in the literature. A specimen in the Australian Museum collection from New Caledonia (Plate 22, fig. 7) matches Sowerby's illustration and description very well and it is possible that New Caledonia was actually the type locality. Several specimens from Queensland also appear to be this species.

M. (M.) cuspidatus is rather similar to some forms of *M. octogonus* and was considered to be a synonym of that species by Tryon (1880). The varices in specimens that were probably collected in the lower littoral zone are dark brown and the spines short (as in fig. 7). This form best matches the illustration of the type specimen. Others obtained from deeper water are uniformly coloured and usually have longer spines (Plate 22, fig. 6). A similar variation is seen in *octogonus* (Ponder, 1968). All but one (C. 69053) of the Australian specimens seen are of the long-spined form and one small specimen from Noumea (C. 3955) also has long spines.

The shell has 7-8 varices on the body whorl and has 4 primary spines on the body whorl varices plus 2 on the canal. The short-spined form has some intermediate (secondary) spines developed almost to the same extent as the primary spines. There are 6 strong denticles inside the outer lip and 2 on the inner lip just above the neck of the anterior canal. The largest specimen available is 36 mm x 19 mm (excluding spines). The operculum and radula (Text fig. 3: 26) are like those of other species of *Muricopsis* (s.s.).

Australian Localities: Fairfax Island, Bunker Group, off Gladstone, Queensland (C. 69053); Swain Reefs, Queensland (C. 72866); 9 metres, Swain Reefs, Queensland (C. 77185); 28-36 metres, Gillett Cay, Swain Reefs, Queensland (C. 72671); 20 miles N. of Herald Prong, No. 1 Reef, Swain Reefs, Queensland (C. 77186). Several additional specimens in the collection of Neville Coleman, Sydney, have been examined. These are from 9 metres, Swain Reefs, Queensland and Tryon Island, Capricorn Group, Queensland at 8 metres on compacted coral rubble.

Muricopsis (Muricopsis) purpurispina sp. nov.

Plate 23, fig. 6; Text fig. 3: 28

Shell: Small, elongate, with strong varices and short spines. Protoconch of $1\frac{1}{2}$ smooth, tilted, very slightly shouldered whorls. Lamellae continuous with the varices of the 1st whorl of the teleoconch extend on to the protoconch. Whorls of teleoconch $4\frac{1}{4}$, usually bluntly shouldered, sometimes more acutely. Body whorl with 5-7 varices, 7-8 on penultimate whorl and 8-9 on antepenultimate whorl. Spiral sculpture rather irregular and 5 primary cords on the body whorl commencing at the shoulder, above which lie about 5 weak spirals. A single intermediate cord lies between each primary rib and is about $\frac{1}{2}$ as strong. A single strong cord on the pillar has 3 weaker spirals above it and two below. All spiral cords produced into very short, open spines at the varices, but these

are usually worn off. Irregular weak axial lamellae cross the surface giving it a scaly appearance. Some specimens have the 1st primary cord stronger than the others which produces a prominent shoulder. Fasciole with the remnants of the previous anterior canals forming spines. Aperture with inner lip spread beyond columella; outer lip thin, extends beyond varix, with 5 strong denticles on its anterior 2/3rds. Anterior canal rather short, not closed, slightly curved dorsally. Colour pinkish-brown to pale reddish-brown, with the 4th primary spiral cord white, the others sometimes with patches of white. Varices sometimes paler than rest of shell and with at least some of the spines dark purplish as is dorsal part of canal and fasciolar spines.

Operculum: red-brown, rather thin, with a terminal nucleus.

Radula (from holotype): central tooth with 5 cusps, median one strongest, lateral projections and basal, median swelling present. Lateral tooth simple (Text fig. 3: 28).

Animal: Head-food unpigmented, reddish-brown splashes on mantle edge. Holotype a mature female.

Dimensions: Height: 16.20 mm. Diameter: 7.72 mm (holotype)
16.65 mm. 8.00 mm (paratype)

Locality: In fish trap, 36 metres off Minnie Waters, northern N.S.W., Collected L. Bale, holotype (C. 76796) and 6 paratypes (C. 76797).

Additional Material Examined: 40 metres, off Manning River, N.S.W., 1 specimen (C. 16819); Angourie, Clarence River, northern N.S.W., many worn shells (C. 77034, C. 77036, C. 77037); Wooli, Northern N.S.W., 1 worn shell (C. 77035); off Moreton Bay, Queensland, 27° 27′22″ S, 153°39′ E, 77 metres, W. F. Ponder on H.M.A.S. *Kimbla.* 1 shell (C. 77065).

Subgenus *Spinidrupa* Habe and Kosuge, 1966

Type species: (o.d.) *Murex eurantha* A. Adams, 1851.

The radula of the type species of this genus has not been described and the generic relationships of its contained species have been the source of some considerable confusion.

Murex nodulifera Sowerby, 1841 is very similar to *eurantha* and may prove to be identical. It is found throughout the tropical Indo-Pacific but is nowhere common. Occasional specimens are found in Queensland, the species being represented in the Australian Museum collections by juvenile shells from two localities (9-15 metres, Murray Island, Torres Strait (C. 77285), Low Isles, Queensland (C. 77283, C. 77284). An adult shell from off Mossman, Queensland, is in Neville Coleman's collection. *Murex (Trophon) fruticosus* Gould, 1849 is a synonym of *nodulifera.* The type is recorded as coming from Sydney, Australia, but this is certainly an error.

Cernohorsky (1967) placed *nodulifera* in *Poirieria* Jousseaume, 1880. I would agree with Vokes (1970b) that Cernohorsky was in error and that *Muricopsis* would be a better location because of the overall teleoconch similarity and the protoconch of *nodulifera* is like that of species of *Muricopsis. S. nodulifera* and *eurantha,* have 2 prominent rows of spines

on the body whorl and the radula of a related form is dissimilar (Text fig. 3: 29), although the operculum is very like that of species of *Muricopsis* (s.s.).

This radula was obtained from a specimen from New Caledonia. The shell (Plate 22: 2) agrees with *nodulifera* in most features except that there are 4 rows of spines in place of the 2 rows of swollen knobs usually seen in *nodulifera*. Careful examination of typical *nodulifera* shows that the knobs are formed by the fusion of 2 rows of spines and in some specimens they remain separate, especially in the basal row. In other features the shells are similar. Both typical *nodulifera* and the New Caledonian form illustrated have 3 denticles on the columella near the neck of the anterior canal and about 7-8 on the outer lip. Species of *Muricopsis* (s.s.) normally have 1-2 denticles on the columella.

The radula differs from species of *Muricopsis* in having a wide but shallow basal plate from which the cusps stand upright as in *Murex* and *Pterynotus*. Until a specimen of the type species can be examined the relationships of this puzzling group of species will remain uncertain. Certainly on shell features the New Caledonian cf. *nodulifera* comes very close to *Muricopsis* but the radula features would appear to allow it at least subgeneric distinction.

DISCUSSION

One of the most disturbing aspects of the classification of the Muricidae is the difficulty in placing genera in the various subfamilies recognised. These include the Muricinae, Ocinebrinae (= Tritonaliinae), Typhinae, Trophoninae and Rapaninae. The Thaididae should probably also be regarded at best, as a subfamily of the Muricidae. The question of the validity of these groups on anatomical grounds will be discussed elsewhere. Suffice to say that several genera placed in the Muricinae by Vokes (1964) have since been shown to be better located in the Ocinebrinae and vice versa. This proves that on shell features, and in some cases on opercular features, accurate placement is impossible in these two subfamilies. Powell's (1951) descriptions of the radulae of *Trophon* species would place the species of this genus in 4 different subfamilies. The radulae of species of the Thaidinae also show a similar gradation and certainly on shell features it is impossible to draw a distinct line between any of these groups. It would seem that, until a more satisfactory means of determining subfamilial relationships in the Muricidae (if such subfamilies exist) can be formulated, these should be put aside.

PLATE 23.

1 - 5. *Maculotriton bracteatus* (Hinds). 1 — Holotype of *Tritonidea petterdi* Brazier (Nat. Mus. Vict. F. 649); 2 — Cato Island, Queensland (C. 68582); 3 — Lady Musgrave Island, Capricorn Group, Queensland (C. 77187) *; 4 — Clarence River, northern N.S.W. (C. 77188); 5 — Holotype of *Clathurella* (?) *waterhouseae* Brazier (C. 8668).

6. *Muricopsis (Muricopsis) purpurispina* sp. nov. 33 metres off Minnie Waters, northern N.S.W., holotype (C. 76796). *

7. *Aspella (Aspella) anceps* (Lamarck). Woolgoolga, N.S.W. (C. 76671). *

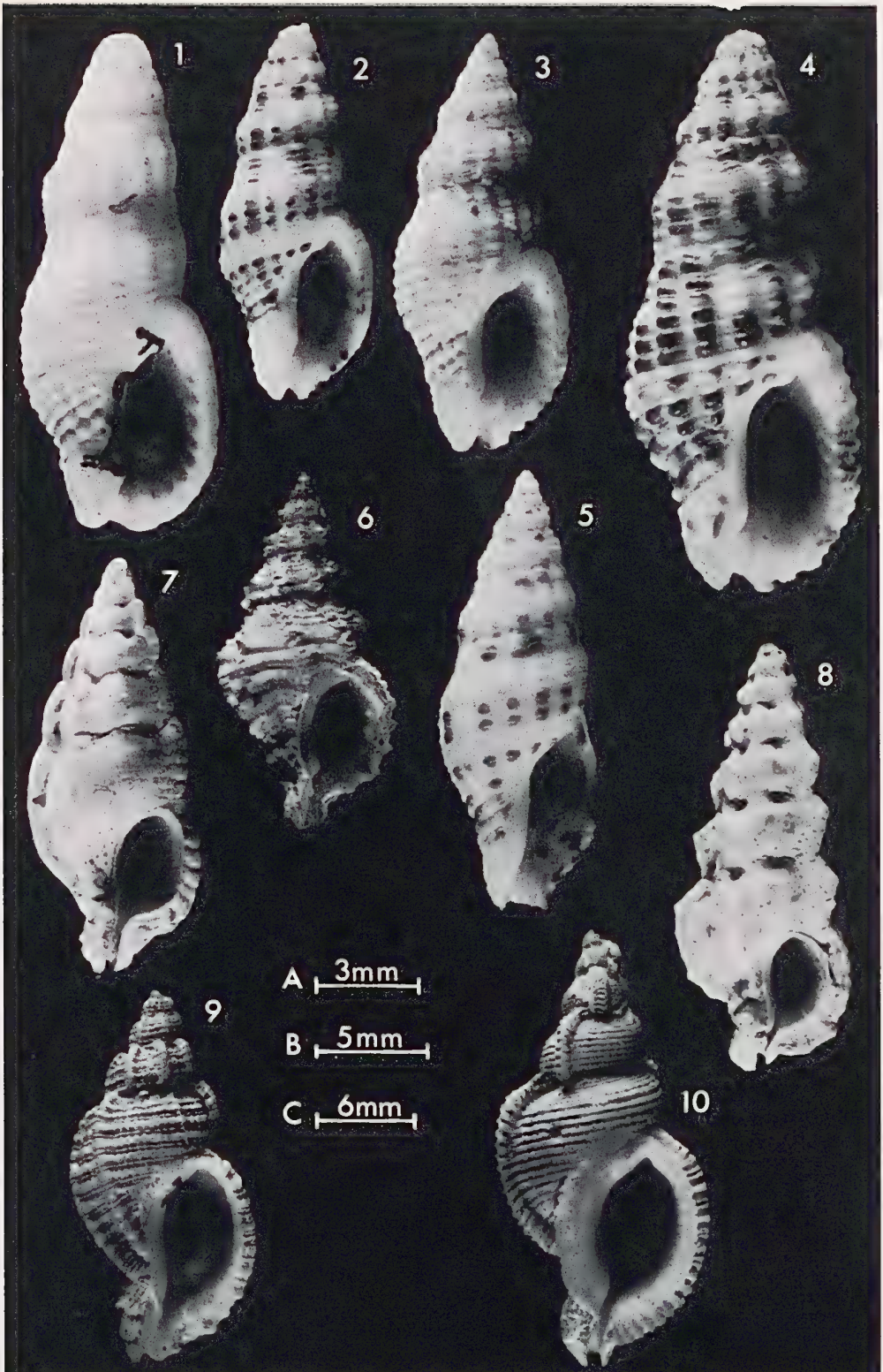
8. *Aspella (Aspella) producta* (Pease). Low Isles, near Port Douglas, Queensland (C. 76881).

9. *Phyllocoma (Galfridus) speciosa speciosa* (Angas). Watson's Bay, Sydney, N.S.W. (C. 76669). *

10. *Phyllocoma (Phyllocoma) convoluta* (Broderip). Suva Harbour, Fiji (C. 67022). *

Scale A: fig. 1 - 5, 7; Scale B: fig. 6, 9, 10; Scale C: fig. 8.

* Specimens from which figured radulae obtained.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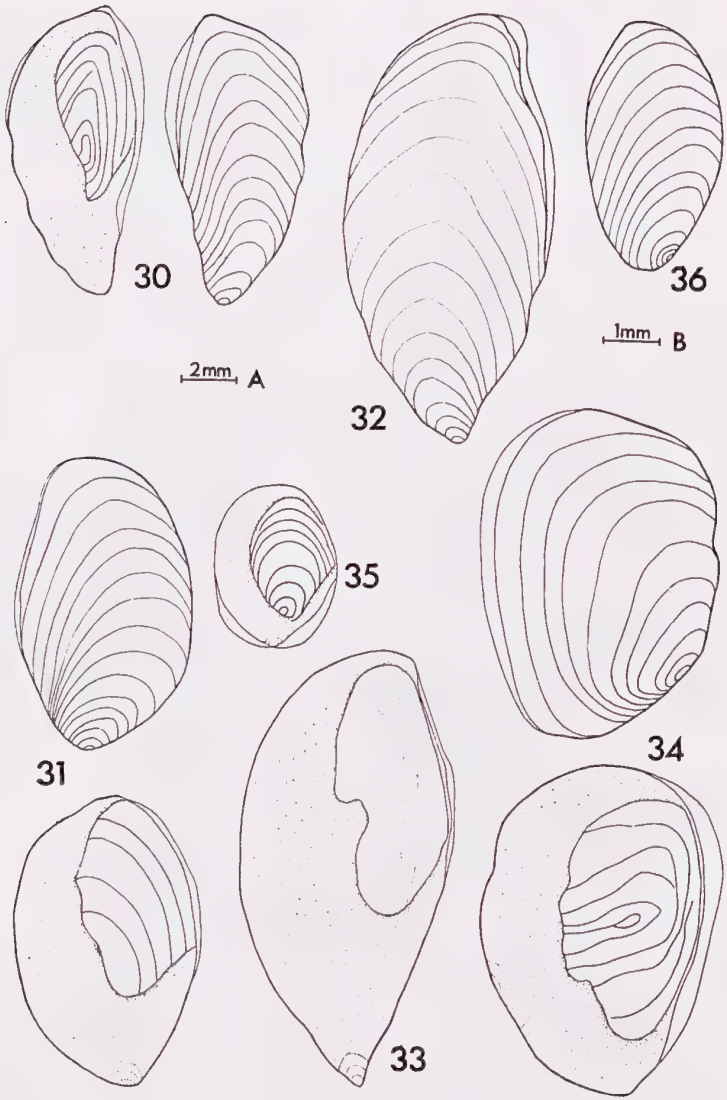

TEXT FIG. 4. Operculae

30. *Pterynotus (Pterochelus) bednalli* (Brazier). Swires Bluff, Darwin Harbour, Northern Territory (C. 71742).

31. *Muricopsis (Muricopsis) octogonus octogonus* (Quoy and Gaimard). Auckland, New Zealand (C. 76323).

32, 33. *Pterynotus (Pterochelus) triformis* (Reeve). 4 - 6 metres, N.W. Arm, Western Port Bay, Victoria (C. 76555).

34. *Pteropurpura (Ocinebrellus) falcatus* (Sowerby). Kii, Japan (C. 66915).

35. *Favartia (Favartia) brevicula* (Sowerby). New Caledonia (C. 36409).

36. *Phyllocoma (Galfridus) speciosa speciosa* (Angas). Watson's Bay, Sydney, N.S.W. (C. 76669).

Scale A: fig. 30 - 35; Scale B: fig. 36

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